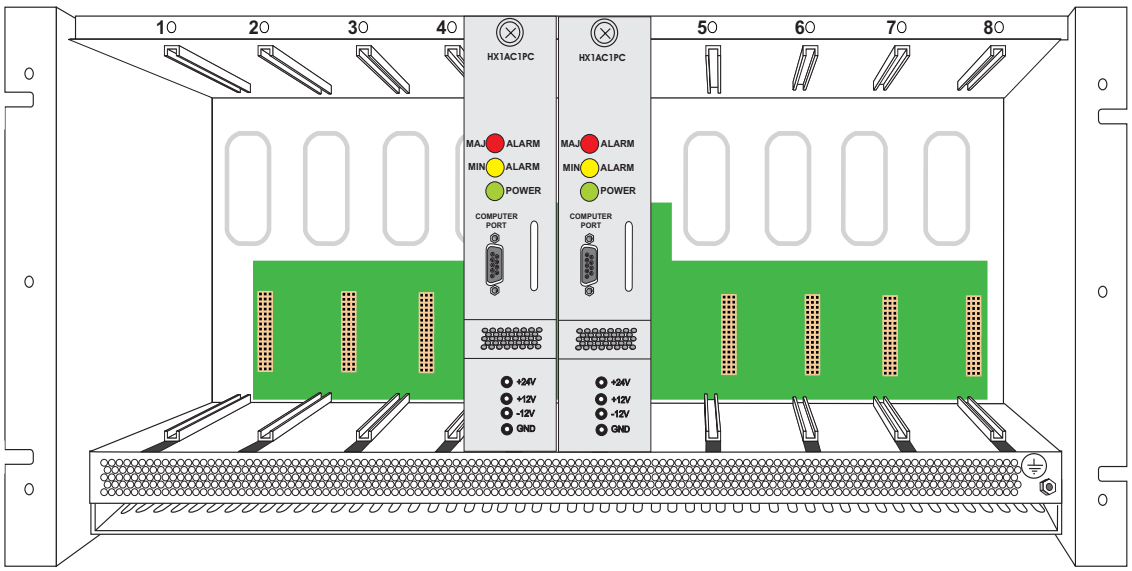
Universal Equipment Shelf and Power Supply/ Controller

Procedures Manual

1074320 Rev B



C-COR.net

Procedures Manual
for
Optiworx™ HWX
Universal Equipment Shelf
and
Power Supply/Controller

HX2281EC - Shelf
HX1481PC - Power Supply/Controller
HX3481PC - Power Supply/Controller
HX1AC1PC - Power Supply/Controller
HX1AC2PC - Power Supply/Controller

C-COR.net

Universal Equipment Shelf and Power Supply/Controller

C-COR.net Document Number: 1074320, Revision B

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ABOUT THIS MANUAL

This manual is written to provide a system engineer/technician with information to install and operate the HX2281EC HWX Universal Equipment Shelf and associated Power Supply/Controllers.

Revision History

REVISION	DATE	REASON FOR CHANGE
A	4/00	Initial release covering the HX2281EC HWX Universal Equipment Shelf and HX1AC1PC Power Supply/Controller.
A2	7/01	Update to include HX1AC2PC (220 VAC Power Supply/Controller) and HXFANxxx Fan Assembly; added HX3481PC external fuse feature. Added ECR 20084717A/ECD 20094815; Shelf PS/C fuse rating silkscreen on rear panel.
B	10/01	Trademark Update

Related Publications

Listed below are several related manuals that may be useful to users of this one.

Title/Description	Part Number
HWX 750 MHz DFB Laser Transmitter Installation and Operation Manual Contains information on requirements for installation and operation of the HWX 750 MHz, 1310 nm transmitter modules in an HWX equipment shelf.	**060675-001**
HWX 870 MHz DFB Laser Transmitter Installation and Operation Manual Contains information on requirements for installation and operation of the HWX 870 MHz, 1310 nm transmitter modules in an HWX equipment shelf.	**060676-001**
HWX Forward Path Receiver HX7118RX Installation and User Instruction Manual Contains information required for installation and operation of HWX HX7118RX Modules in an HWX equipment shelf.	**060916-000**
HWX Forward Path Receiver HX7128RX Installation and User Instruction Manual Contains information required for installation and operation of HWX HX7128RX High Performance Modules in an HWX equipment shelf.	**1033053**
HWX Forward Path Receiver HX7138RX Installation and User Instruction Manual Contains information required for installation and operation of HWX HX7138RX High Output Modules in an HWX equipment shelf.	**1047020**

Title/Description	Part Number
HWX Single Return Path Receiver Installation and Operation Manual Contains information required for installation and operation of HWX HX6213RX Single Return Path Receiver Modules in an HWX equipment shelf.	**1114022**
HWX Dual Return Path Receiver Installation and Operation Manual Contains information required for installation and operation of HWX HX6213RX Dual Return Path Receiver Modules in an HWX equipment shelf.	**060917-001**
HWX Dual Return Path Receiver Installation and Operation Manual Contains information required for installation and operation of HWX HX6213RXM Dual Return Path Receiver Modules in an HWX equipment shelf.	**1168391**
HWX Quad Return Path Receiver HX6413RX Installation and User Instruction Manual Contains information required for installation and operation of HWX HX6413RX Quad Return Path Receiver Modules in an HWX equipment shelf.	**1058848**
HWX 1550 nm EDFA Optical Amplifier Installation and User Instruction Manual Contains information required for installation and operation of HWX EDFA Amplifier Module (HX8xxxAM) in an HWX equipment shelf.	**1031384**
HWX 1550 nm EDFA Optical Amplifier Installation and User Instruction Manual Contains information required for installation and operation of HWX EDFA Amplifier Module (HX8xxxFA) in an HWX equipment shelf.	**1183132**
HWX 1550 nm Transmitter Installation and User Instruction Manual Contains information required for installation and operation of an 1550 nm Transmitter Module (HXxx50XL/XLA) in an HWX equipment shelf.	**1031385**
HWX 1550STX Broadcast Transmitter Installation and User Instruction Manual Contains information required for installation and operation of an HX3870XP, 1550STX Transmitter Module in an HWX equipment shelf.	**1074319**
HWX 1550 nm Externally Modulated Broadcast Transmitter Installation and User Instruction Manual Contains information required for installation and operation of an HXx870X, 1550 nm Transmitter Module in an HWX equipment shelf.	**1134317**

Title/Description	Part Number
Optiworx Integrated Fan/Power Supply Installation Instructions Manual Contains information required for installation and operation of an Integrated Fan/Power Supply Module in a rack or cabinet.	**060914-001**
Optiworx HWX Control Panel Software User Guide A Windows™ based Craft software program for accessing equipment modules installed in an HWX equipment shelf.	**1025580**
Smart-Nett™ User's Manual (DV and Optiworx Products) A DOS software program designed for remote network management. Contains information required for monitoring of operating parameters, remote control of certain operating options, and alarm reporting of Optiworx equipment units.	**060919-001**
OSWorx™ Commander Operating Guide A Unix based software program designed for remote network management. Contains information required for monitoring of operating parameters, remote control of certain operating options, and alarm reporting of Optiworx equipment units.	**1025530**

Admonishments

Important safety admonishments are used throughout this manual to warn of possible hazards to persons or equipment. An admonishment identifies a possible hazard and then explains what may happen if the hazard is not avoided. The admonishments — in the form of Dangers, Warnings, and Cautions — must be followed at all times. These warnings are flagged by use of the triangular alert icon (seen below), and are listed in descending order of severity of injury or damage and likelihood of occurrence.

⚠ **Danger**: *Danger is used to indicate the presence of a hazard that **will** cause severe personal injury, death, or substantial property damage if the hazard is not avoided.*

⚠ **Warning**: *Warning is used to indicate the presence of a hazard that **can** cause severe personal injury, death, or substantial property damage if the hazard is not avoided.*

⚠ **Caution**: *Caution is used to indicate the presence of a hazard that **will** or **can** cause minor personal injury or property damage if the hazard is not avoided.*

General Safety Precautions

This equipment conforms to the requirements of a Class I laser product as defined in the US Department of Health and Human Services, Bureau of Radiological Health Regulation 21 CFR Subchapter J.

While Class I radiation levels are not exceeded when equipment components are handled per instructions, enough invisible infrared energy is emitted from the end of an active fiber to damage the retina of the eye. To avoid potentially dangerous laser radiation, follow the operating and servicing procedures set forth in this manual in the sequences specified. DANGER labels on the equipment alert users to the potential for exposure to hazardous amounts of invisible radiation.

⚠ **Warning:** *DO NOT look into a transmitter's optical bulkhead receptacle or an active fiber end emanating from a transmitter. DO NOT look at an optical fiber that is connected to an operating transmitter but not connected to a receiver or customer's network. There may be no visible indication of light, but invisible radiation can seriously damage the* retina of the eye. *Immediately place a cap or hood over any radiating bulkhead receptacle or connector to avoid potentially dangerous radiation exposure. In addition to helping prevent injury, capping connectors also keeps dirt particles from entering them. C-COR.net also strongly recommends that you turn optical amplifiers off before performing fusion splicing.*

⚠ **Caution:** *This equipment is electrostatic discharge sensitive. To prevent electrostatic discharge damage, wear a grounded wrist strap when you touch an equipment unit. Always place units on an approved, grounded antistatic surface. Use antistatic packaging material when transporting equipment.*

FCC Compliance Statement

⚠ **Warning:** *This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with limits for a Class A digital device pursuant to Part 15 of the FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference to TV and radio reception in which case the user, at their own expense, will be required to take whatever measures may be required to correct the interference.*

This equipment does not exceed Class A limits for radio emission for digital apparatus, set out in the radio interference regulation of the authorization methods of Industry Canada. Operation in a residential area may cause unacceptable interference to TV and radio reception requiring the owner or operator to take whatever steps are necessary to correct the interference.

HWX Applicable Standards Compliance Matrix

HX2281EC Equipment Shelf

COUNTRY/TYPE	STANDARD
Safety	
US	UL-1950
Canada	CSA C22.2 No. 950
European Union	EN-60950
EMI	
US	FCC Part 15, Subpart B, Class A
Canada	ICES-003
European Union	EN55022-A EN50083-2
EMC	
European Union	EN50082-1: 1997 EN50083-2: 1995
International Standard	IEC-801: 1984

HX1481PC Power Supply/Controller

COUNTRY/TYPE	STANDARD
Safety	
US	UL-1950
Canada	CSA C22.2 No. 950
European Union	EN-60950
EMI	
US	FCC Part 15, Subpart B, Class A
Canada	ICES-003
European Union	EN55022-A EN50083-2
EMC	
European Union	EN50082-1: 1997 EN50083-2: 1995
International Standard	IEC-801: 1984

HX3481PC Power Supply/Controller

COUNTRY/TYPE	STANDARD
Safety	
US	UL-1950
Canada	CSA C22.2 No. 950
European Union	EN-60950:
EMI	
US	FCC Part 15, Subpart B, Class A
Canada	ICES-003
European Union	EN55022-A EN50083-2: 1995
EMC	
European Union	EN50082-1: 1997
International Standard	IEC-801: 1984

HX1AC1PC/HX1AC2PC Power Supply/Controller

COUNTRY/TYPE	STANDARD	
	HX1AC1PC	***HX1AC2PC***
Safety		
US	UL-1950	
Canada	CSA C22.2 No. 950	
European Union	EN-60950:	
Australia	AS-3260	
International Standard	IEC-950	
EMI		
US	FCC Part 15, Subpart B, Class A	
Canada	ICES-003	
European Union	EN55083-2: 1995	
Australia	AS-3548-1992	
International Standard	CISPR 22	
EMC		
European Union	EN50083-2: 1995	
International Standard	IEC-801: 1984	

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DESCRIPTION

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1. GENERAL DESCRIPTION

1.01 The HWX Universal Transmission Platform consists of one HX2281EC Equipment Shelf installed with either one or two HX1481PC, HX3481PC, HX1AC1PC and/or HX1AC2PC Power Supply/Controller modules, and any of the following optional plug-in modules.

- HWX 1310 nm DFB Transmitter Modules
- HWX 1310/1550 nm Forward and Return Path Receiver Modules
- HWX 1550 nm Transmitter and Optical Amplifier Modules
- Any other functional HWX plug-in modules

Information about these modules are contained in other individual equipment manuals. Refer to Front Matter, *"Related Publications"*, in this manual for applicable manual part numbers.

1.02 The combination of the HWX Universal Equipment Shelf and either one or two Power Supply/Controller modules provides the basic power distribution and remote and/or local network management control for the optional plug-in modules installed in each shelf. Table 1-1 provides a matrix of the functional enhancements and the model numbers that have brought the HWX Universal Equipment Shelf and Power Supply/Controller to its present functionality.

1.03 Unique to this shelf is that the backplane regulated DC voltages required to power the functional plug-in modules can be obtained from either an AC and/or DC source. -48 VDC is connected to the HWX backplane terminal blocks where it is distributed to the DC Power Supply Controllers (HX1481PC or HX3481PC). AC is connected directly to the Power Supply/Controllers: HX1AC1PC (115 VAC) or HX1AC2PC (220 VAC). This now provides another dimension in redundancy, primary AC with DC battery back-up.

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A. HWX Universal Equipment Shelf

1.04 The HX2281EC Equipment Shelf occupies 5 RU of rack space and is designed to conform to the dimensional requirements of NEBS (Network Equipment Building Standard). Each shelf will accommodate up to eight optional plug-in HWX modules (slots 1–8) and two dedicated, power-conditioning/controller modules, slots (P1 and P2). The shelf provides primary regulated power distribution, interface, and environmental support for the optional plug-in modules installed. The shelf can accept either AC or DC power. The HX2281EC Equipment Shelf supports local alarm reporting when used with the HX1481PC, HX3481PC, HX1AC1PC, or HX1AC2PC HWX Power Supply/Controllers which contain and control the alarm relays.

1.05 For each equipment shelf that is installed, a 1 RU fan assembly (the new HXFANxxx series or DV69xxFAN or HW-PSFAN-x-xxx) is required. The fan assembly type is dependent upon the primary power available at the site (see Table 1-2 for details). The fan unit installs directly above ***each*** HWX shelf. It draws cooling air through the front of the integral heat baffle located in the front of the equipment shelf, and vents it out from the top of the fan assembly.

1.06 The HWX Transmission Platform is designed to provide multiple configurations to satisfy a wide range of application needs. As an example, each HWX Universal Equipment Shelf can hold up to a combination of eight 1310 nm DFB Transmitter or Forward/Reverse Path Receiver modules; or one feed-forward 1550 nm Transmitter module (4 slots/module) with up to two EDFA Optical Amplifiers (2 slots/module). This highly flexible system gives the customer a variety of choice of wavelength, bandwidth, and optical output power levels.

B. Power Supply/Controller Modules

1.07 The HWX Power Supply/Controller module is a plug-in module which provides two primary functions:

- DC/DC conversion of primary input power (AC or DC) provides regulated backplane power to the HWX Universal Equipment Shelf and microprocessor-based system control and network management interfaces.

Although only one HWX Power Supply/Controller module is required for operation, two units may be used to provide high reliability through module and power input redundancy. The Power Supply/Controller module provides control, monitoring, and alarm functions for all equipment in the shelf. It responds to C-COR.net's HWX Control Panel software for local provisioning, monitoring and control.

1.08 The Power Supply/Controller modules also respond to Optiworx SMART-NETT and OSWorx Commander software, supplying remote network management and system monitoring. The craft port and remote network management interfaces support both 9600 and 19200 baud rates. The appropriate controllers are installed in a HX1281EC or HX2281EC equipment shelf to provide access to the alarm relay contact closures through the ALARM terminal block on the rear panel of the shelf. The Power Supply/Controller modules provide full support for 1550 nm equipment (transmitters and amplifiers), and can be used to download new software into any HWX plug-in module. The older version model of the Power Supply/Controller (HX2481PC) and shelf (HX1281ES) do not support all these features.

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C. Product Enhancements

HWX Universal Equipment Shelf

1.09 The original HWX Equipment Shelf was the HX1281ES, which required -48 VDC as its primary power input source. This model was replaced with the HX1281***EC*** that added remote alarm capabilities when used with either the HX1481PC or HX3481PC Power Supply/Controllers. The HX1281EC is now replaced with the HX2281EC that has all the capabilities of the HX1281EC plus the ability to power the shelf with either -48 VDC **and/or** AC (115 or 220 VAC) primary input power (see Table 1-1).

Power Supply/Controllers

1.10 The earliest version of the HWX Power Supply/Controller Module was the HX2481PC. The HX2481PC was replaced by the HX1481PC to support improvements to other hardware and new HWX optional plug-in modules. The HX1481PC was then replaced with the HX3481PC to include a low input voltage protection circuit. Newer versions of the HX3481PC now have a replaceable fuse accessable from the rear of the module. Both the HX1481PC and the HX3481PC require -48 VDC primary power as their primary input power source.

1.11 The newest additions to the Power Supply/Controller family are the 115 VAC (HX1AC1PC) and 220 VAC (HX1AC2PC) Power Supply/Controllers. They incorporate all the features of the HX3481PC, but provide the user with the capability of using AC as a primary power input source. These Power Supply/Controllers can only be used in the HX2281EC HWX Universal Equipment Shelf.

1.12 The HX1481PC, HX3481PC, HX1AC1PC and HX1AC2PC all allow new firmware to be downloaded to installed modules through the network software. Table 1-1 indicates the HWX Universal Equipment Shelf and Power Supply/Controller models, indicating the functional enhancement(s) of each.

Table 1-1. Functional Enhancements to Shelf and Power Supply/Controllers

FUNCTIONAL ENHANCEMENTS	EQUIPMENT SHELF (HX)			POWER SUPPLY/CONTROLLER (HX)				
	1281ES	1281EC	2281EC	2481PC	1481PC	3481PC	1AC1PC	1AC2PC
Provide Local Alarm Relays		X	X		X	X	X	X
Download Plug-in Module Firmware		X	X		X	X	X	X
Accept 1550nm Amplifier and Transmitters		X	X		X	X	X	X
Accept SMART-NETT and OSWORX Network Software		X	X		X	X	X	X
Low Voltage Protection CircuitX		X	X			X	X	X
-48 VDC Input Power	X	X	X	X	X	X		
VAC Input Power			X				115	220

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2. PHYSICAL DESCRIPTION

A. HWX Universal Equipment Shelf

2.01 The HX2281EC HWX Universal Equipment Shelf is a 19” rack or cabinet mountable unit, which measures 17.20” wide by 8.75” high (5 RU) by 11.00” deep, and weighs approximately 8.5 pounds (unpopulated). It provides physical, environmental, and network interface support for up to eight (8) optional plug-in modules and two (2), dedicated Power Supply/Controller modules. The shelf is designed to operate with both AC **and/or** DC voltages as primary input power. The physical design of the shelf prevents you from inserting the optional functional modules into the Power Supply/Controller dedicated slots (P1 and P2), and also from inserting the Power Supply/Controller modules into any of the optional functional module slots (1 through 8).

2.02 Each slot is equipped with upper and lower card guides for easy module insertion, and a rear connector to a half-height rear mounted backplane. The center two slots, P1 (Primary slot) and P2 (Secondary slot), are dedicated for the Power Supply/Controller Modules (see Figure 1-1).

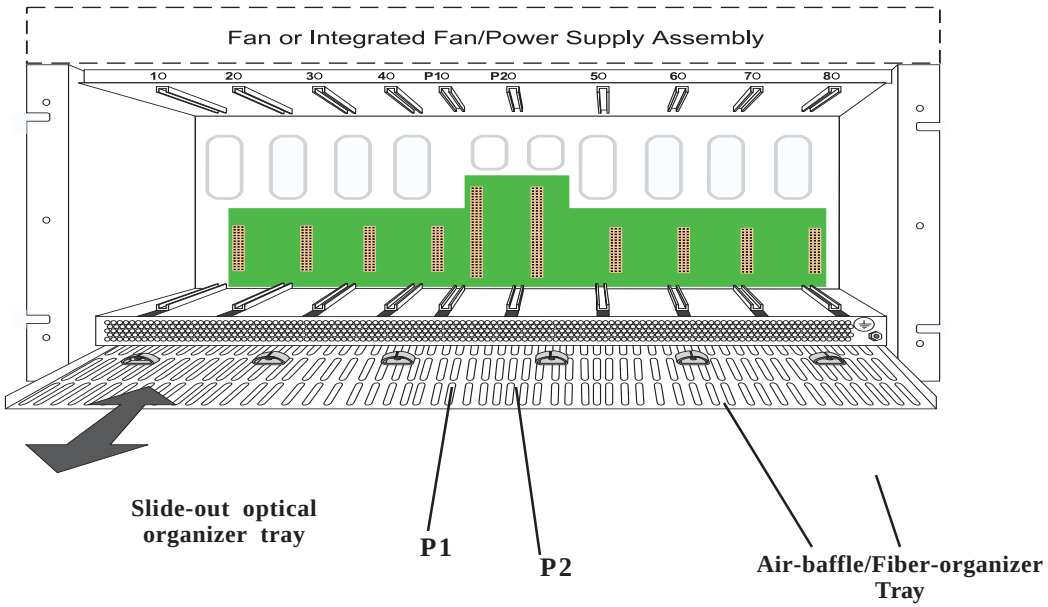

Figure 1-1. HX2281EC HWX Universal Equipment Shelf Front View

2.03 The backplane provides internal distribution of regulated power and a Standard Peripheral Interface (SPI) communications bus to all modules for status monitoring and control communications. DC primary input power (-48 VDC) comes into the shelf through two terminal strips located on the rear panel (ABAT and BBAT). Two RJ-11 connectors on the rear panel of the shelf provide external access to the communications bus for remote monitoring and control (see Figure 1-2). These two connectors accommodate daisy chain connections to multiple shelves for network management. The HX2281EC shelf has a six position terminal block (ALARMS) that provides connection to the Power Supply/Controllers major and minor alarm relay contacts.

2.04 No RF or optical signal paths are provided through the equipment shelf backplane. All RF input/output connectors are mounted on the rear of the individual HWX plug-in modules. The cables protrude through openings in the back of the shelf for access. All optical input/output connectors are mounted on the front of the individual HWX plug-in modules.

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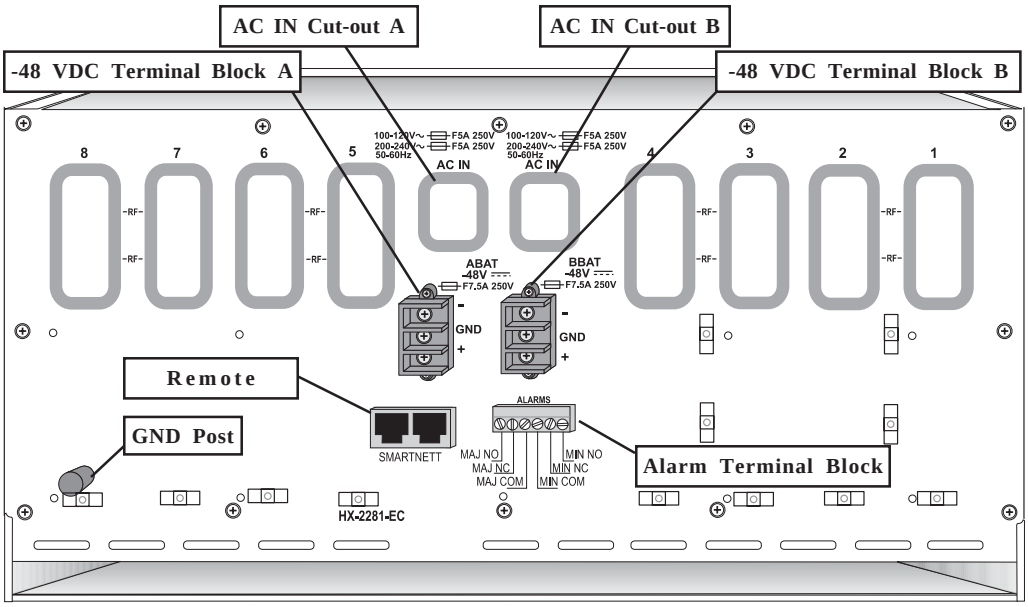
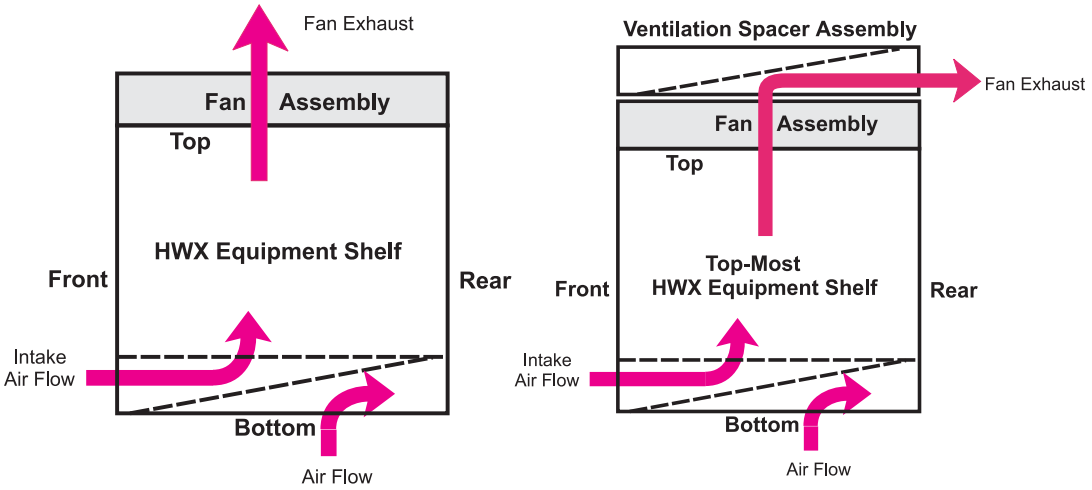


Figure 1-2. HX2281EC HWX Universal Equipment Shelf Rear View

2.05 At the bottom of the shelf is a 1 RU air-baffle/fiber-organizer tray (see Figure 1-1). The slide-out optical organizer tray on the bottom of the shelf provides fiber optic cable management for up to 16 cables, at a maximum length of 36 inches each.

2.06 Total heat dissipation for a fully loaded equipment shelf is approximately 220 watts. A single 1 RU fan (HXFANxxx or DV69xxFAN or HW-PSFAN-x-xxx) ***must*** be installed above ***each*** populated shelf to provide proper air flow. The fan assembly will draw intake air from the front of the shelf's air intake baffle and deflect it up through the plug-in modules. The warm air is then exhausted from the top of the fan assembly. Any air exhausted beneath the shelf will be deflected to the back of the rack or cabinet (see Figure 1-3a). To ensure proper heat dissipation and reduced EMI susceptibility, empty equipment slots in the shelf ***must*** be covered. Empty Power Supply/Controller slots (P1 or P2) must be covered using blank panel HX1281BP, and empty optional functional module slots (1–8) using blank panel HX1281BM.



a. Without Ventilation Spacer Assembly **b. With Ventilation Spacer Assembly**

Figure 1-3. Cross-Sectional View of HX2281EC Shelf Air Flow Pattern

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2.07 To provide controlled outlet air, the *topmost shelf* in a rack or cabinet will require a Ventilation Spacer assembly (see Figure 1-4). The installation of this unit will allow for future installation of rack mountable equipment above the fan assembly without presenting exhaust air flow problems. The air exhaust from the topmost shelf fan assembly is directed to the rear of the rack or cabinet (see Figure 1-3b). If at some time in the future an HWX Universal Equipment Shelf is installed on top of the topmost shelf, the ventilation spacer assembly should be removed, and then reinstalled on the new topmost unit in the rack or cabinet.

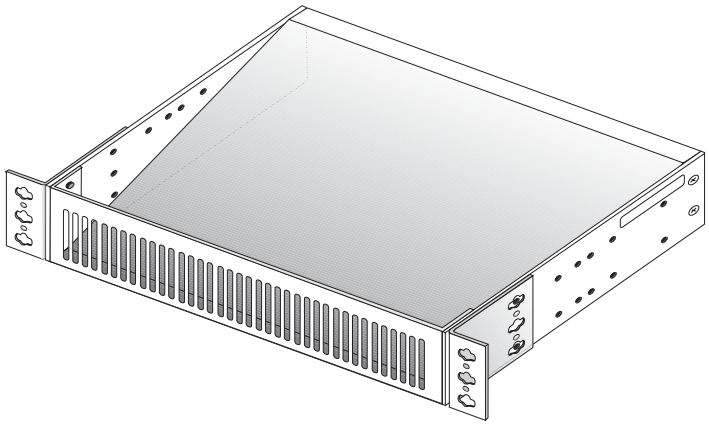

Figure 1-4. Ventilation Spacer Assembly HDW-100461

2.08 Table 1-2 indicates the fan assemblies that can be used with the HX2281EC Universal Equipment Shelf and associated Power Supply/Controllers, based on the input power sources available. Power Supply/Controller models shown in Slot P1 and Slot P2 are interchangeable, and are only shown as is to indicate the possible combinations of AC and DC models that can be used in a shelf. Only the new HXFANxxx series is shown, but the older version DV69xxFAN or HW-PSFAN-x-xxx (if supplying -48 VDC to shelf) can be used in its place.

Table 1-2. Primary Power vs. Fan and Power Supply/Controller Options For HX2281EC Equipment Shelf

Site Primary Power		Power Supply Controller		Fan Assembly	
AC	DC	Slot P1	Slot P2	Fan	Fan/PS
115/220		HX1AC1PC/2PC	HX1AC1PC/2PC	HXFAN110/220	
115/220		HX3481PC	HX3481PC		HW-PSFAN-x-xxx
115/220		HX1AC1PC/2PC	HX3481PC		HW-PSFAN-x-xxx
	--48	HX3481PC	HX3481PC	HXFAN48	
115/220	--48	HX1AC1PC/2PC	HX3481PC	HXFAN48	
115/220	--48	HX1AC1PC/2PC	HX3481PC	HXFAN110/220	
115/220	--48	HX1AC1PC/2PC	HX3481PC		HW-PSFAN-x-xxx

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B. Power Supply/Controller Modules

2.09 The HWX Power Supply/Controller modules plug into one of the two dedicated center slots in an HWX Universal Equipment Shelf. There, it provides two primary functions; converting primary input power (AC or DC) to +24 and ±12 VDC regulated outputs; and microprocessor-based system control through a local or remote network management interface. The circuits that perform these functions are contained on two printed circuit boards and assembled with a heat sink, mechanical enclosure, necessary fasteners and miscellaneous hardware to form the complete module.

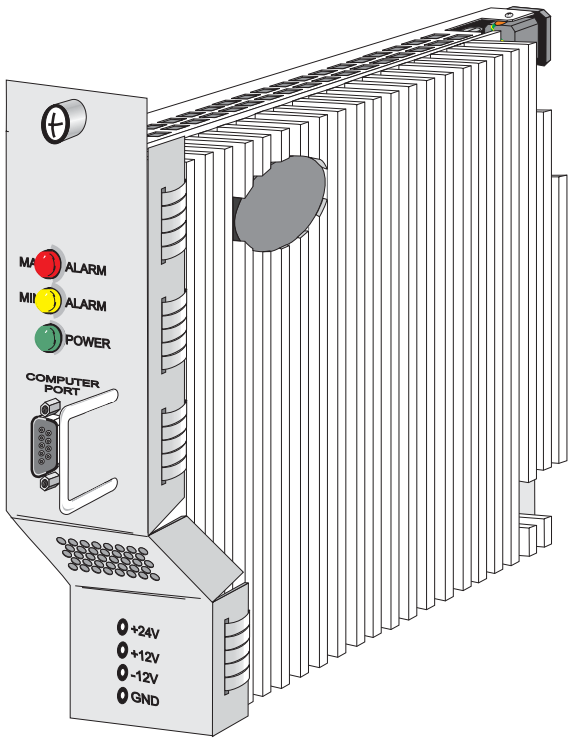

Figure 1-5. HWX AC Power Supply/Controller

Note: Although Figure 1-5 is an illustration of the AC version of the Power Supply/Controller, the front panel controls are identical for the DC Power Supply/Controllers.

2.10 The Power Supply/Controller module measures 1.7" W x 6.7" H x 9.3" D and weighs approximately 5 lbs. It is designed to operate from 0°C to +50°C at 10% to 90% relative humidity (noncondensing). A DIN, style C, three row, 96 pin connector, that mates with the equipment shelf backplane receptacle, provides the regulated voltage, SPI communications, and remote network interface. Primary AC power to the AC models is connected to an IEC 3-pin adapter, on the rear of the AC modules.

2.11 One Power Supply/Controller module is all that is needed to support a fully loaded shelf. However, two slots are provided to enable increased network reliability through redundancy. If the primary Power Supply/Controller is removed from the shelf or any of the DC converter output voltages (+24 VDC or ±12 VDC) exceed design specifications (not the alarm threshold settings), power and control is automatically switched to the secondary Power Supply/Controller module, with minimal disturbance to the backplane DC outputs.

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2.12 A Quick Reference Guide (Figure 1-6) has been provided to facilitate location of information on each of the Power Supply/Controller module's controls, LED indicators, and connectors. The illustration has reference labels for these items that indicate the appropriate page number where pertinent information can be obtained. Table 1-3, *"Power Supply/Controller Front Panel Indicators, Connector, and Test Points"* also provides information on all of the front panel items.

2.13 Table 1-3 describes the front panel indicators, connector, and test points provided for local monitoring of the HWX Power Supply/Controller.

Table 1-3. Power Supply/Controller Front Panel Indicators, Connector, and Test Points

TYPE	NAME OF INDICATOR	FUNCTION
LED (green)	POWER	This indicator *flashes green* on an **active** (primary) module, and glows *steady green* on an **inactive** (redundant or secondary) module, when a valid +12 VDC output is present.
LED (red)	MAJ ALARM	On a **primary** PS/C module, this indicator lights *red* to signal any of the following ***system* major alarm conditions**: • Major alarm condition on any optional plug-in modules On a **primary *or* secondary** PS/C module, this indicator lights *red* to signal any of the following ***local* major alarm conditions**: • +24 VDC output is within major alarm threshold range • +12 VDC output is within major alarm threshold range • -12 VDC output is within major alarm threshold range
LED (yellow)	MIN ALARM	On a **primary** PS/C module, this indicator lights *yellow* to signal any of the following ***system* minor alarm conditions**: • A Minor alarm condition on any optional plug-in modules • If a redundant PS/C module is installed, any minor or major failure in the redundant module. On a **primary *or* secondary** PS/C module, this indicator lights *yellow* to signal the following ***local* minor alarm condition**: • +24 VDC output is within minor alarm threshold range • +12 VDC output is within minor alarm threshold range • -12 VDC output is within minor alarm threshold range • -48 VDC (A or B) is absent (on threshold -20V, off -37V) • Unused -48VDC input terminal enabled, or AC input < 80 VAC (HX1AC1PC), or AC input < 170 VAC (HX1AC2PC)
Connector	COMPUTER PORT	DB-9, 9 pin female connector. Provides craft software interface.
Test Point[Note1]	+24V	Accesses the +24VDC supply on the shelf backplane (±2.4V)
Test Point[Note1]	+12V	Accesses the +12VDC supply on the shelf backplane (±0.6V)
Test Point[Note1]	-12V	Accesses the -12VDC supply on the shelf backplane (±0.6V)
Test Point[Note1]	GND	Provides access to chassis ground

Note 1: These test points monitor the voltage on the HWX equipment shelf backplane, they DO NOT indicate the voltage produced by the individual Power Supply/Controller DC converters. Each individual power supply DC voltage can only be monitored through the local or remote network management software telemetry fields.

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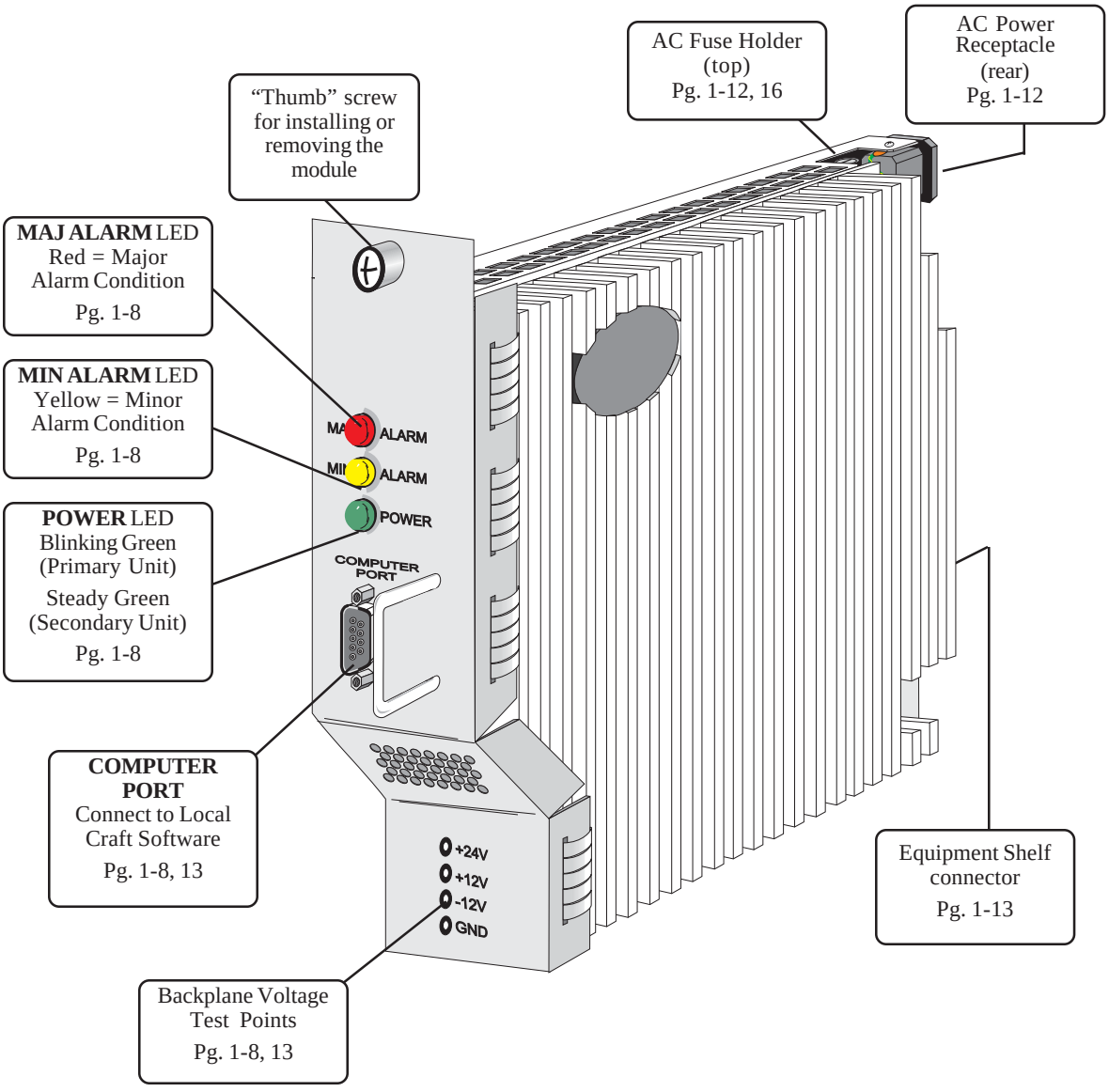
POWER SUPPLY/CONTROLLER QUICK REFERENCE GUIDE


AC Fuse Holder (top) Pg. 1-12, 16
AC Power Receptacle (rear) Pg. 1-12
"Thumb" screw for installing or removing the module
MAJ ALARM LED Red = Major Alarm Condition Pg. 1-8
MIN ALARM LED Yellow = Minor Alarm Condition Pg. 1-8
POWER LED Blinking Green (Primary Unit) Steady Green (Secondary Unit) Pg. 1-8
COMPUTER PORT Connect to Local Craft Software Pg. 1-8, 13
Backplane Voltage Test Points Pg. 1-8, 13
Equipment Shelf connector Pg. 1-13
ALARM
ALARM
POWER
COMPUTER PORT
+24V
+12V
-12V
GND

Note: Although this is an illustration of the AC version of the Power Supply/Controller, the front panel is identical for the DC Power Supply/Controllers.

Figure 1-6. Power Supply/Controller Quick Reference Guide

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3. FUNCTIONAL DESCRIPTION

A. HWX Universal Equipment Shelf

3.01 The dual -48 VDC inputs (ABAT and BBAT) are "OR"ed on both the input and return lines to isolate any possible fault, including shorts between supply and return, shorts from either supply or return to ground, or on-board component failures. A fuse is contained in (or external for the newer HX3481PC) the DC Power Supply/Controller, and the input supply lines are diode-protected against reversed polarity. In addition to the input protection, a monitoring circuit communicates the status of the -48 VDC supply inputs to the Power Supply/Controller.

3.02 AC input requirements are made through the AC Power Supply/Controllers and not the HWX Universal Equipment Shelf (refer to paragraph 3.08). A standard 115 VAC line cord or 220 VAC line cord (not supplied) is connected to the Power Supply/Controller's IEC, 3-pin AC adapter located on the rear panel of the module, through a cut-out in the rear of the HWX Universal Equipment Shelf. An external fuse is accessible at the top-rear of the module.

3.03 The Power Supply/Controller functions can be accessed remotely by either C-COR.net's Optiworx SMART-NETT or OSWorx Commander network management software. Two (RJ-11) RS-485 connections are provided on the rear panel so that multiple units can be daisy chained for network management. Table 1-4 list the pinouts for the remote RS-485 interface.

Note: The Power Supply/Controller module ***cannot*** be accessed remotely while it is connected locally to the HWX Control Panel software through the DB-9 connector located on the front panel of the Power Supply/Controller.

Table 1-4. HWX Universal Equipment Shelf Rear Panel RS-485 (RJ-11) Pinout

NAME	PIN #	DESCRIPTION
	1	Not present
	2	Not used
RS485+	3	Balanced input/output
RS485-	4	Balanced input/output
	5	Not used
	6	Not present

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B. Power Supply/Controller Modules

3.04 The Power Supply/Controllers provide both power and network controller monitoring and control functions. Except for the input power to the DC/DC converters that generate the regulated DC power requirements for the HWX shelf, their operation is identical and transparent to the user.

Power Supply Section

3.05 The power supply section of the of the modules are used to generate the regulated +24, +12 and -12 VDC voltages to the HWX backplane, where these regulated voltages are used to power the functional plug-in modules.

3.06 The DC versions of the Power Supply/Controllers (HX1481PC and HX3481PC) provide DC/DC conversion of the -48 VDC input power source from the HWX backplane (Figure 1-7). The input DC to the module is fused before it is used to power the DC/DC converters that are designed to operate with input supply voltages from -40 to -56.7 VDC. The -48 VDC is then applied to the three DC/DC converters. The regulated output voltages are then applied to the equipment shelf backplane.

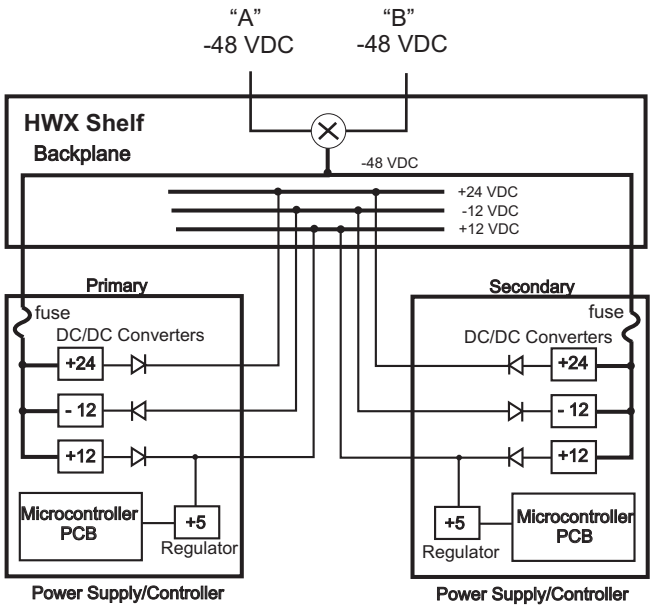

Figure 1-7. DC Power Supply/Controller Simplified Block Diagram

3.07 Installing two DC Power Supply/Controllers (HX1481PC and/or HX3481PC) in an HWX Equipment Shelf provide both module (power and control) and DC input power (separate battery sources) redundancy. Loss of either battery "A" or battery "B" will not affect system operation. The primary module will remain "primary" and continue to provide the regulated power to the backplane and system control. Switchover from primary to secondary will occur 100 msec after loss of the primary's Master/Slave (M/S) signal. The secondary controller will relinquish control when it again senses the M/S signal from the primary controller.

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3.08 The 115 VAC AC version of the Power Supply/Controller (HX1AC1PC) operates with input supply voltages from 90 to 125 VAC. The 220 VAC AC version of the Power Supply/Controller (HX1AC2PC) operates with input supply voltages from 180 to 264 VAC. The input AC to the module is fused, filtered and rectified before it is used to power the DC/DC converters (Figure 1-8). As in the DC version of the module, the converters then produce the regulated output voltages (+24, +12 and -12 VDC) for the equipment shelf backplane.

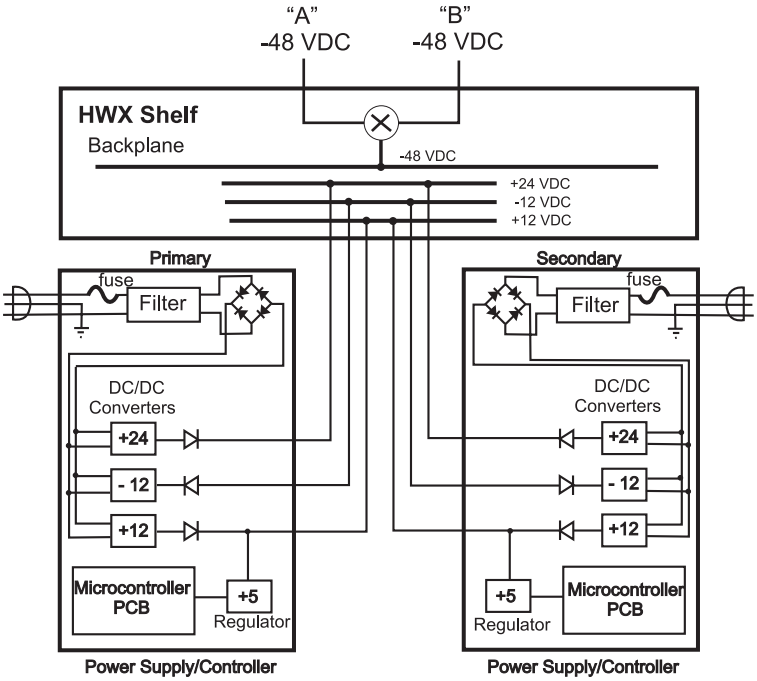

Figure 1-8. AC Power Supply/Controller Simplified Block Diagram

3.09 In the AC versions, AC *input power redundancy* can only be attained if separate AC line sources are made available. Also note that in an AC redundant configuration, inadvertent loss of AC power to the Primary module will cause the Secondary module to provide the DC power to the HWX shelf backplane, ***but*** the Primary module will remain the primary controller (blinking green POWER LED). This is because the controller circuitry takes its power from the HWX backplane (+12 VDC) and not its internal DC/DC converter output. Switchover from primary to secondary will occur 100 msec after loss of the primary's Master/Slave (M/S) signal. The secondary controller will relinquish control when it again senses the M/S signal from the primary controller.

3.10 The Power Supply/Controllers do not have to be the same version in a given shelf (AC or DC), they can be mixed as long as the primary input power requirements are available.

3.11 The output of the three primary Power Supply/Controller converters (all models) are used to supply power to the HWX backplane, where it provides all the power to the HWX shelf optional plug-in modules:

+24 VDC (±10%) @ 0-5 amps

+12 VDC (±5%) @ 0-5 amps

–12 VDC (±5%) @ 0-2 amps

The output of the converters also include output-voltage sense lines, to provide regulation of the output voltage at the point of load.

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3.12 Each module is equipped with four (4) front panel test points, which can be used to measure the three module supply voltages (+24 VDC, +12 VDC, and -12 VDC), and Ground, *on the HWX equipment shelf backplane*.

Note: These test points DO NOT indicate the voltage produced by the individual Power Supply/Controller DC converters. Each individual DC converter output voltage can only be monitored through the local or remote network management software telemetry fields.

Network Controller Section

3.13 The Power Supply/Controller module is the control interface for the shelf and its installed modules. The operator can access the controller on-site using the local craft HWX Control Panel software. It is loaded onto a PC that connects to the controller through the front panel RS-232 (DB-9) port. Through the controller, the HWX Control Panel operator can control configuration settings and alarm thresholds, monitor alarm status, and view operating parameters for all installed modules. Table 1-5 lists the pinouts for the RS-232 interface.

Note: The module cannot be accessed *remotely* while it is connected locally to the HWX Control Panel software via the DB-9 connector.

Table 1-5. Front Panel RS-232 (DB-9) Pinout

NAME	PIN #	DESCRIPTION
	1	Not used
RX	2	Data output from the module (±12 VDC)
TX	3	Data input to the module (±12 VDC)
DTR	4	Data Terminal Ready (±12 VDC)
GND	5	Signal Ground
DCR	6	Data Circuit Ready (±12 VDC)
	7	Not used
	8	Not used
	9	Not used

3.14 The communication architecture of the backplane is based on the Serial Peripheral Interface (SPI) Standard. A Master/Slave relationship exists between the controller and each of the installed modules. Only one master may exist in a shelf and it shall be the only device to initiate communications to any card. If a redundant Power Supply/Controller module is installed, the left-most (Primary) module will assume the role of master, and become active, while the right-most (Secondary) module monitors its own levels and assumes the role of a slave controller. The primary controller will toggle a “Master/Slave” (M/S) signal to let a secondary controller know that it is active and operational.

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3.15 The M/S signal exchange occurs after every executive routine to inform the secondary that the primary controller is up and running. The secondary Power Supply/Controller module will automatically assume the role of master if it does not sense the toggle of the M/S signal from the primary master within 100 ms from the last toggle. The secondary controller will assume that the primary controller "crashed" or was removed from the shelf, or is no longer functional. If the secondary is acting as master and the primary again becomes available, the signalling from the primary will return and the secondary will automatically relinquish control back to the primary.

3.16 During each executive routine cycle the master controller will poll all slots. While polling, it will read card status and the appropriate analog to digital information for telemetry purposes. It will also detect the type of device that is installed and keeps track of what cards have been swapped, taken out, or reinstalled. If any changes are made by swapping or unplugging, the master controller is notified during a poll command. This is not treated as an error but gives the master controller the most recent information.

3.17 Communication between the master Power Supply/Controller module and the slave installed modules occurs when the master "SELECT"s the installed module by sending qualifying logic to the slot position and enabling the module to respond. Timing for backplane communications is provided by the master Power Supply/Controller modules clock. Once a module is selected by the master an exchange of data occurs. The master copies the information from the slave and the slave copies the information from the master.

3.18 The Power Supply/Controller Flash Controller printed circuit board contains the major and minor alarm relays that can be used to connect to local alarm devices. The master Power Supply/Controller will control the status of the alarm relays. In a redundant system, the relays in the slave controller will be inactive.

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4. SPECIFICATIONS

4.01 Specifications for the HX2281EC Universal Equipment Shelf are shown in Table 1-6. Specifications for the AC and DC Power Supply/Controllers are shown in Table 1-7.

Note: Specifications listed are current as of the date of publication of this manual. C-COR.net reserves the right to change specifications without prior notice. You may verify the product specifications by contacting Sales or Technical Support.

Table 1-6. HWX Universal Equipment Shelf Specifications

CHARACTERISTIC	SPECIFICATION
PHYSICAL	
Rack Mount Dimensions	17.2" W x 8.75" H x 11.0" D
Number of module slots	10: 8 slots for optional plug-in modules, and 2 slots dedicated for Power Supply/Controller modules
Weight	approx. 8.5 lbs., unpopulated 45 lbs., fully loaded
Module Slot Dimensions	1.7" W x 6.7" H x 9.3" D
Fiber Management	Integrated Fiber Management Tray
Ventilation	Integral heat baffle, and required external fan assembly
POWER	
Input Power DC:	–40 to –56.7 VDC, @ 4 A max, pass through to power supply module
115 VAC:	HX1AC1PC Power Supply/Controller(s)
220 VAC:	HX1AC2PC Power Supply/Controller(s)
Power Consumption	220 W max, fully loaded
ENVIRONMENTAL	
Operating Temperature	0°C to +50°C
Storage Temperature	–40°C to +80°C
Operating Relative Humidity	0 to 90%, non-condensing
Cooling	1 RU fan assembly ***required*** for each shelf.

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Table 1-7. Power Supply/Controller Specifications

CHARACTERISTIC	SPECIFICATION		
MECHANICAL			
Dimensions	1.7" W x 6.7" H x 9.3" D		
Weight	approx. 5 lbs.		
POWER			
	HX3481PC	HX1AC1PC	HX1AC2PC
Input Power	–40 to -56.7 VDC @4 A Typ.	90 to 132 VAC @ 5 A max.	180 to 264 VAC @ 3 A max.
Fuse	5A, internal, or 7.5A, 32 VDC Fast Acting, Blade-type external	5A, 250V Fast Acting 5x20mm	5A, 250V Fast Acting 5x20mm
Low Voltage Input Limits			
Turn Off	–30 VDC min.	80 VAC min.	170 VAC min.
Turn On	–37.5 ±5 VDC	90 VAC max.	180 VAC max.
Power consumption	25 Watts max.		
Output Power	+24VDC (±10%) @0-5A +12VDC (±5%) @0-5A –12VDC (±5%) @0-2A		
NETWORK INTERFACE			
Front Panel Interface	RS-232 craft port		
Baud Rate	9600 or 19200		
Connector Type	9-pin Subminiature-D (DB-9), Female		
MAJOR/MINOR ALARM RELAYS			
Contact Ratings	10 W, 200 VDC, 0.5 A		
ENVIRONMENTAL			
Temperature			
Storage	–40°C to +80°C		
Operating	0°C to +50°C		
Relative Humidity			
Storage	0 to 95%, non-condensing		
Operating	0 to 90%, non-condensing		

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SECTION 2
INSTALLATION

Content	Page
1. GENERAL	2-1
2. HOW TO USE THIS SECTION	2-1
3. SAFETY INFORMATION	2-2
INSTALLATION TASK INDEX LIST	2-3
TOP PROCEDURES	2-4

1. GENERAL

1.01 This section presents the procedures for unpacking, installing, and connecting primary power to the HX2281EC Universal Equipment Shelf and fan assembly in the rack or cabinet; unpacking and installing the Power Supply/Controller(s) in the shelf; performing initial turn-up and test of the Equipment Shelf, fan or fan/power supply, and Power Supply/Controller module(s).

2. HOW TO USE THIS SECTION

2.01 The procedures in this section are written in the Task Oriented Practice (TOP) format. TOP procedures are step-by-step instructions for completing indicated tasks. To find instructions for installing the HWX Universal Equipment Shelf and Power Supply/Controller(s), proceed as follows:

1. Find the task to be performed in the Installation Task Index List (IXL-001).
2. Locate the procedure for the task. Each procedure in this manual is one of the following types:
   a) Non Trouble clearing Procedure (NTP) - Directive level procedure listing normal work items to be performed.
   b) Detail Level Procedure (DLP) - Detailed step-by-step instructions.
3. Perform all the items in the NTP in the order listed unless you are sent to another NTP. When you finish an NTP, you have completed the task. For more detailed information, you may be referred from the NTP to a detailed level procedure (DLP-xxx). Detail Level Procedures may also direct you to other Detail Level Procedures.

Note: If one NTP sends you to another, in most cases you need not return to the first NTP after finishing the second.

Note: When you complete a DLP, return to the procedure which sent you to the just-completed DLP.

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3. SAFETY INFORMATION

3.01 This section presents safety information pertinent to the procedures for installation of the HWX Universal Equipment Shelf, fan assembly and Power Supply/Controllers; initial turn-up and test.

⚠ **Warning:** *To prevent electrical shock, never install electrical equipment in a wet location or during a lightning storm.*

⚠ **Warning:** *To avoid exposure to invisible laser radiation, do not look into the ends of any optical fiber connectors or bulkhead adapters. Use an optical power meter to identify active fibers. Do not assume that laser power is turned off or that a fiber is disconnected at its far end.*

⚠ **Warning:** *Infrared radiation is invisible and can seriously damage the retina of the eye. To avoid potentially dangerous radiation exposure, immediately place a protective cap or hood over any radiating bulkhead receptacle or optical fiber connector. This practice also keeps dirt particles from entering the connector.*

⚠ **Caution:** *HWX equipment is electrostatic discharge sensitive. To prevent electrostatic discharge damage, wear a grounded wrist strap when you touch equipment units. Always place units on an approved, grounded antistatic surface. Use antistatic packaging when transporting equipment.*

⚠ **Caution:** *This equipment generates, uses, and can radiate radio frequency energy. If it is not installed and used in accordance with the instruction manual, it may cause interference to radio communications. It has been tested and found to comply with limits for a Class A digital device pursuant to Subpart B of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference from equipment operated in a commercial environment. Operation of this equipment in a residential area may cause interference to TV and radio reception, in which case the user, at his own expense, must take whatever measures may be required to correct the interference.*

This equipment does not exceed the Class A limits for radio emission for digital apparatus set out in the radio interference regulations of the Canadian Department of Communications. Operation in a residential area may cause unacceptable interference to TV and radio reception, requiring the owner or operator to take whatever steps are necessary to correct the interference.

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INSTALLATION TASK INDEX LIST

Find Your Job in the List Below	Then Go To:	Pg:
INSTALL HX2281EC UNIVERSAL EQUIPMENT SHELF	**NTP-002**	**2-4**
Inspect Installation Site	**DLP-500**	**2-7**
Unpack Equipment and Inspect for Damage	**DLP-501**	**2-8**
Mount HWX Universal Equipment Shelf in Rack or Cabinet	**DLP-502**	**2-9**
Installing HXFANxxx or DV69xxFAN Rack Mount Fan	**DLP-503**	**2-12**
Installing HW-PSFAN-x-xxx Integrated Fan/Power Supply	**DLP-504**	**2-16**
Installing HDW-100461 Ventilation Spacer	**DLP-505**	**2-21**
Connecting HWX Universal Equipment Shelf to Office Ground	**DLP-506**	**2-24**
Connecting HWX Universal Equipment Shelf to Office Power Plant	**DLP-507**	**2-25**
Connecting Power Supply/Controller Local Alarm Relays	**DLP-508**	**2-27**
INSTALL POWER SUPPLY/CONTROLLER MODULES	**NTP-003**	**2-5**
Installing Power Supply/Controller Modules in HWX Shelf	**DLP-509**	**2-29**
Connecting Local Craft or Remote Network Management Interface	**DLP-510**	**2-31**
INITIAL TURN-UP AND TEST	**NTP-004**	**2-6**
Perform Initial Functional Check of HWX Universal Equipment Shelf, Fan Assembly, and Power Supply/Controller Modules	**DLP-511**	**2-33**
Check Power Supply/Controller Switching (Redundancy)	**DLP-512**	**2-53**
Installing Functional Modules and Blank Panels in HWX Shelf	**DLP-513**	**2-56**

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INSTALL HX2281EC UNIVERSAL EQUIPMENT SHELF

Summary: This procedure describes how to unpack and install an HX2281EC Universal Equipment Shelf, a 1 RU HWX shelf fan assembly (HXFANxxx, DV69xxFAN, or HW-PSFAN-x-xxx), and a Ventilation Spacer (HDW-100461) assembly in a rack or cabinet.

⚠ **Warning:** *Multiple shelf installations in a rack or cabinet require the installation of a fan assembly above **each** HWX Universal Equipment Shelf.*

Do Items Below in the Order Listed	For Details Go To:	Pg:
1. Examine the system and site plans to become familiar with the HWX shelf location and the associated equipment.	DLP-500	2-7
2. Unpack the HWX shelf and associated mounting hardware and inspect each item for damage.	DLP-501	2-8
3. Orient mounting brackets on the equipment shelf as required by rack or cabinet panel size and mounting requirements. If required, install extender brackets. Mount the HWX shelf in its assigned position.	DLP-502	2-9
4. Unpack ventilation fan and spacer unit(s) and associated mounting hardware. Inspect each item for damage.	DLP-501	2-8
5. Install required fan assembly: HXFANxxx or DV69xxFAN rack mount fan. Required for each equipment shelf *not using* an Integrated Fan/Power supply unit. Orient mounting brackets on the shelf as required by rack or cabinet panel size and mounting requirements.	DLP-503	2-12
or		
HWX Integrated Fan/Power Supply (HW-PSFAN-x-xxx) assembly. Orient mounting brackets on the shelf as required by rack or cabinet panel size and mounting requirements. Connect office ground and wire –48 VDC output to the HWX equipment shelf.	DLP-504	2-16
6. Installation of the ventilation spacer assembly (HDW-100461).	DLP-505	2-21
7. Connecting HWX equipment shelf to office ground.	DLP-506	2-24
8. If using office DC power, connecting the HWX equipment shelf to the office DC power circuits.	DLP-507	2-25
9. OPTIONAL - Connect local alarm devices to the Power Supply/Controller alarm relay contacts.	DLP-508	2-27

Stop! You have completed this procedure.

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INSTALL POWER SUPPLY/CONTROLLER MODULES

Summary: This procedure describes how to unpack and insert the Power Supply/Controller modules into the equipment slots of an HX2281EC HWX Universal Equipment Shelf, and make network management connections.

Do Items Below in the Order Listed	For Details Go To:	Pg:
1. Unpack the Power Supply/Controller module(s) and inspect each item for damage.	DLP-501	2-8
2. Install Power Supply/Controller module(s) in the HWX shelf.	DLP-509	2-29
3. Connecting the Power Supply/Controller module to the local craft or equipment shelf remote network management interface. This enables control and status monitoring of the HWX shelf via local control software or a remote network management system running Optiworx SMART-NETT or OSWorx Commander software.	DLP-510	2-31

Stop! You have completed this procedure.

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INITIAL TURN-UP AND TEST

Summary: Turn-up and test procedures for an HX2281EC HWX Universal Equipment Shelf, fan assembly, and Power Supply/Controller(s) consists of performing the following items:

Do Items Below in the Order Listed	For Details Go To:	Pg:
1. Turn on AC and/or DC power to the shelf, check fan operation, and monitor initial Power Supply/Controller front-panel indications for normal operation.	DLP-511	2-33
2. If the shelf contains a redundant Power Supply/Controller, check that switching between primary and secondary Power Supply/Controller modules occur as intended when the primary module fails.	DLP-512	2-53
Note: Refer to individual installation manuals for information on the HWX functional plug-in modules to be installed in the equipment shelf. The manual part numbers are provided in the Front Matter of this document, under the heading *"Related Publications."*		
3. Install optional plug-in modules in the HWX Universal shelf and blank panels to cover any unused shelf slots.	DLP-513	2-56

Stop! You have completed this procedure.

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INSPECT INSTALLATION SITE

Summary: This procedure is a pre-installation review of system and site plans to ensure that you are familiar with the HWX Transmission Platform system, the office where the equipment is to be installed, the equipment it interfaces with, and the bay(s) in which equipment is to be installed.

1. Obtain and familiarize yourself with the site plans, which should include a full description of each HWX Universal Equipment Shelf to be installed. The site plan should specify what modules are to be installed in each HWX shelf.

2. Be sure that the rack layout allows working access for making connections (ground, power, RF input, and network management cabling) to the shelf rear panel. Access is also needed for routing fiber optic cables through the shelf from the rear for front-panel connections.

3. Be sure that rack layout supports adequate ventilation of each HWX shelf (and any other equipment) to be installed. This generally means that:
   - a one RU fan ***must*** be installed directly above each HWX shelf. The fan type is determined by the source of primary power.
   - a one RU ventilation spacer assembly ***must*** be installed above the topmost HWX shelf in a rack or cabinet ***and*** above an HWX shelf fan assembly when it is directly under any rack mounted module that requires cool air to enter/exhaust from the bottom of the unit.
   - no special provision need be made directly beneath any HWX shelf, as the shelf's integral bottom heat baffle admits cooling air from the front.

4. Be sure the appropriate equipment rack(s) or cabinet(s) have been Installed. Check rack/cabinet panel spacing to ensure that the HWX equipment can be mounted in the configuration selected, and that the proper hardware (brackets, extenders, etc.) have been selected to mount the equipment. Ensure that AC and/or DC primary power availability coincides with HWX equipment requirements (Fan assemblies, Power Supply/Controllers and shelf).

5. Check that required wiring and cabling has been installed:
   - If input DC power is provided by the office power plant, then one or two separately fused connections are required
   - coaxial cables for RF input/output signal connections
   - fiber optic cables for input/output signal connections, and
   - RS-485 wiring if a remote network management connection is to be used.

6. If additional preparatory work is required, notify the appropriate organization.

Stop! You have completed this procedure.

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UNPACK EQUIPMENT AND INSPECT FOR DAMAGE

Summary: Open and inspect shipping boxes. Verify that all parts have been received, and that no shipping damage has occurred.

1. Obtain the following tools and equipment to unpack the equipment:
   - ESD wrist strap
   - ESD antistatic mat
   - Box cutter

⚠ **Caution:** *Electronic equipment can be damaged by static electrical discharge. When handling equipment units, always follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use antistatic packaging when transporting or storing units. When working on a unit, always place it on an approved, electrically grounded antistatic mat.*

2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap connection. Plug the ground plug into a grounded ESD jack.

3. Examine the shipping carton exterior for tears, dents, punctures, etc., that might indicate shipping damage. If found, refer to *"Contacting C-COR.net Technical Support"* in the Front Matter of this manual for instructions on how to proceed.

4. Open the cartons and carefully unpack the equipment. *Do not discard the packing materials at this time.*

5. Check each component against the packing list to make sure that the correct catalog numbers and quantities were received. *Note any discrepancies.*

6. Inspect each item for damage. Check for detached, broken or bent parts, damaged connectors, bent connector pins, and any other physical damage to the unit. Do not install any product that is significantly damaged.

7. If there is any damage to the equipment, refer to *"Contacting C-COR.net Technical Support"* in the Front Matter of this manual for instructions on how to proceed.

8. If the product is undamaged and all components are accounted for, discard packing material if desired. You may still want to save some original shipping cartons and packing materials for reuse should it become necessary to return any equipment.

Stop! You have completed this procedure.

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MOUNT HWX UNIVERSAL EQUIPMENT SHELF IN RACK OR CABINET

Summary: This procedure describes how to mount the HWX Universal Equipment Shelf in a rack or cabinet. The HWX shelf has mounting brackets that can be reoriented so that the shelf can be mounted in ***most*** 19", 23", 24", and 600 mm (with bracket extenders) racks or cabinets. However, the mounting capabilities of the required fan and ventilation spacer assemblies may negate certain mounting configurations. Reference the rack/cabinet hardware requirements listing below for mounting capabilities. Both front and rear access to the rack are required for installation.

1. Obtain the following tools and equipment:
   - ESD wrist strap
   - Flat-blade or Phillips screwdriver to match mounting screws
   - Rack/cabinet hardware requirements (quantity) to mount the shelf:

LEGEND R=Rack, C=Cabinet	**19" R or C**		**24" R or C**		**Telco Ctr Mnt R**		**600mm R or C**	
Fnt=Front Mnt, Ctr=Center Mnt	**Fnt**	**Ctr**	**Fnt**	**Ctr**	**19"**	**23"**	**Fnt**	**Ctr**
Universal Equipment Shelf Mountable in:	Yes	Yes	**No[1]**	**No[1]**	Yes	Yes	Yes	Yes
with the following fan assemblies:	E	E		PSF	E	E	E	PSF
Bracket Extenders P/N								
5RU, 19" to 600mm 002554-001							2	2
Binding Head Machine Screws								
10-32 or 12-24, 1/2 inch	4	4			4	4		
6mm							8	8

Note 1. Although the shelf can be mounted in a 24" space, the ventilation spacer assembly can not be adapted to the 24" spacing requirement. Fan nomenclature: F = HXFANxxx or DV69xxFAN, PSF = HW-FAN-x-xxx, E = Either assembly.

⚠ **Warning:** *To prevent electrical shock, never install electrical equipment in a wet location.*

⚠ **Caution:** *Electronic equipment can be damaged by static electrical discharge. When handling equipment units, always follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use antistatic packaging when transporting or storing units. When working on a unit, always place it on an approved, electrically grounded antistatic mat.*

2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap. Plug the ground plug into a grounded ESD jack.

3. Check that the shelf mounting brackets are mounted in the proper location for the rack or cabinet, and mounting configuration (front or center mounted). If necessary, remove the mounting brackets from the shelf's end plates. Reorient the brackets as required (see Figure 502-1), and reattach them to the shelf in the new orientation, reusing the original attaching screws.

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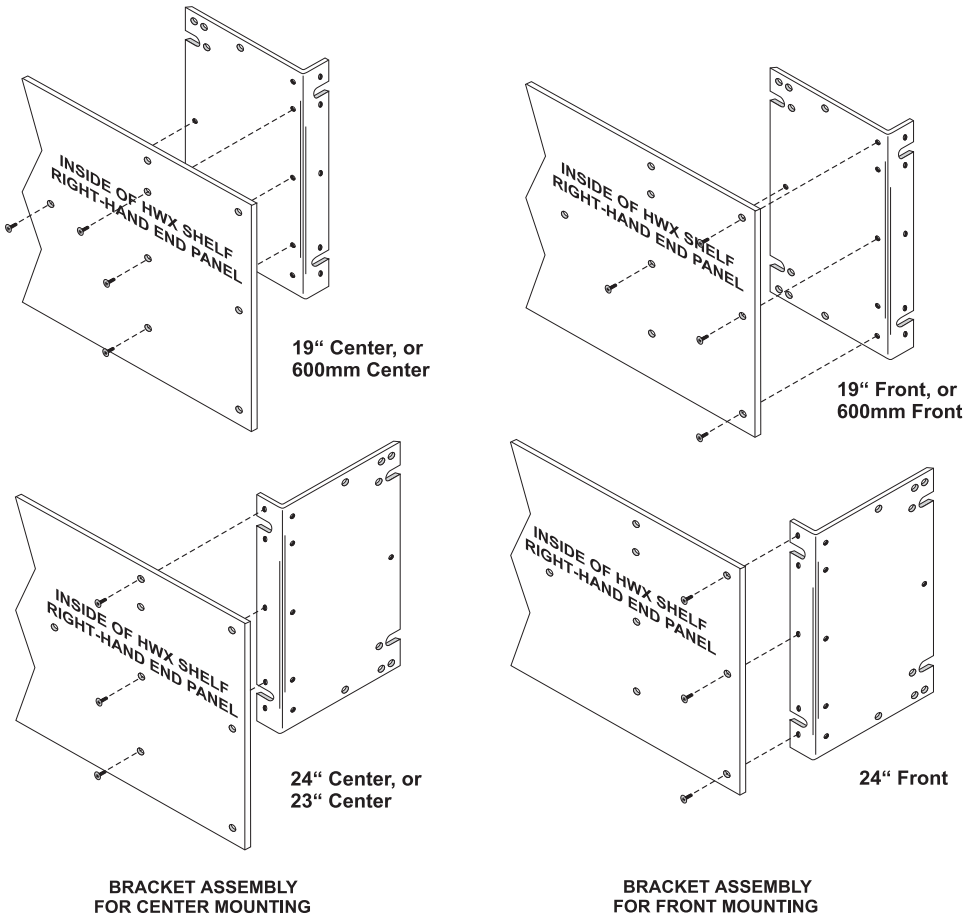

Figure 502-1. Orienting Mounting Brackets for HWX Shelf Mounting Options

4. If the shelf is going to be placed in a 600 mm rack or cabinet, refer to Figure 502-2 for attaching the 19” to 600 mm bracket extenders to the shelf’s mounting brackets (one on each side).

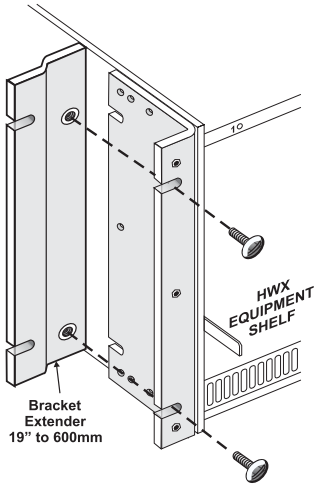

Figure 502-2. Attaching 600 mm Extender Bracket to the HWX Shelf

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Note: When filling a rack or frame with stacked units, start at the bottom and work up to avoid possible tolerance buildup impact on unit spacing. Leave 1 RU empty above each shelf for installation of a fan assembly (DLP-503) or integrated fan/power supply unit (DLP-504). Leave an additional 1 RU space empty above the topmost, fan assembly, for installation of a ventilation spacer assembly (DLP-505).

Note: If the shelf is going to be added to an existing rack or cabinet ***and*** it is to be positioned on top of the existing topmost equipment shelf, remove the ventilation spacer assembly (HW-100461). This ventilation spacer assembly can then be reinstalled on the new topmost shelf in the rack or cabinet.

5. Position the shelf in its assigned location in the rack or cabinet.

Note: If the shelf is going to be placed in a 23" rack, refer to Figure 502-3 for appropriate mounting hole locations.

6. Align the four mounting holes in the mounting brackets with the applicable holes in the rack frame or cabinet rails. Use appropriate mounting screws to secure the shelf to the rack. Tighten the screws securely.

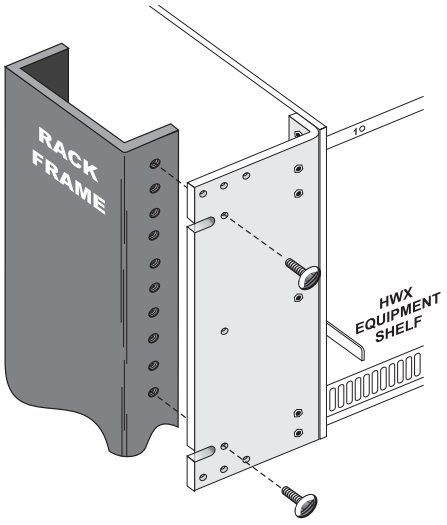

Figure 502-3. Mounting Shelf in a 23" Rack/Cabinet

Stop! You have completed this procedure.

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Page 1 of 4

INSTALLING HXFANxxx or DV69xxFAN RACK MOUNT FAN

Summary: This procedure describes how to mount the HXFANxxx or DV69xxFAN assembly in a rack or cabinet (see the discussion of ventilation requirements in DLP-500). It is recommended to use the new HXFANxxx assembly that is designed specifically for use with the HWX shelf. It is recessed to provide additional space for easy access to the plug-in module thumb screws.

Note: When the HX2281EC Universal Equipment Shelf is powered from -48 VDC office primary power, use the HXFAN48 or DV6948FAN fan assembly; when the shelf is powered from 115 VAC primary power, use the HXFAN110 or DV6911FAN fan assembly; when the shelf is powered from 220 VAC primary power, use the HXFAN220 or DV6922FAN fan assembly.

The fans have a fixed 19" front panel, but with the proper extender/extension brackets can be mounted in a 19", 23", or 600 mm rack or cabinet. Reference the rack/cabinet hardware requirement listing for available extender/extension brackets and associated viable mounting configurations.

Warning: *To prevent electrical shock, never install electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following tools and equipment:
   - Flat-blade or Phillips screwdriver to match mounting screws
   - Rack/Cabinet hardware requirements (quantity) to mount assembly:

LEGEND R=Rack, C=Cabinet		**19" R or C**		**24" R or C**		**Telco Ctr Mnt R**		**600mm R or C**	
Fnt=Front Mnt, Ctr=Center Mnt		**Fnt**	**Ctr**	**Fnt**	**Ctr**	**19"**	**23"**	**Fnt**	**Ctr**
HXFAN xxx or DV69xxFAN mounts in:		Yes	Yes	**No[1]**	**No[1]**	Yes	Yes	Yes	**No[2]**
Bracket Extenders	**P/N**								
1RU, 19" to 600mm	002554-002							2	
Bracket Extender Kit[3]	EB-17R						1		
Bracket Extension Kit[3]	3501		1			1	1		
Binding Head Machine Screws									
10-32 or 12-24, 1/2 inch		4	0			0	0		
6mm								6	

Note 1. No 19" to 24" extender brackets.
Note 2. No extension bracket for 600 mm rack/cabinet
Note 3. Kit contains necessary mounting hardware

   - For HXFAN48 or DV6948FAN only:
     - Wire, 18 AWG (minimum), stranded conductor, length as required
     - Eight (8) insulated fork/spade crimp terminals, to accommodate 18 AWG wire
     - Approved crimp tool

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2. If mounting the fan assembly in a 600 mm rack or cabinet, attach 19” to 600 mm extender brackets to the fan assembly as shown in Figure 503-1. When complete go to step 5.

3. If mounting the fan assembly in a 23” rack, attach 19” to 23” extender brackets to the fan assembly as shown in Figure 503-2b.

4. If *center* mounting the fan assembly in either a 19”-rack/cabinet or 23” rack, attach the 3.5” extension brackets to the rack/cabinet rails as shown in Figure 503-2a (19”-rack) or 503-2b (23”-rack), directly over the HWX equipment shelf.

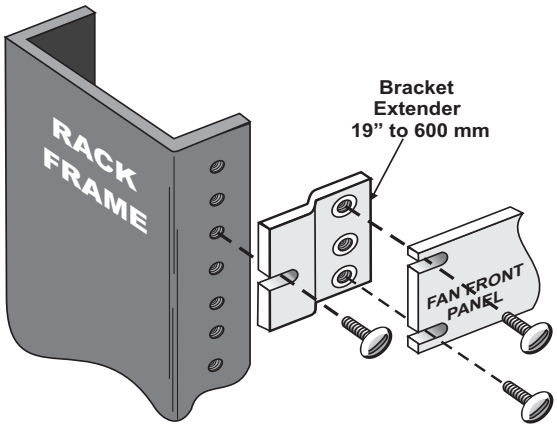
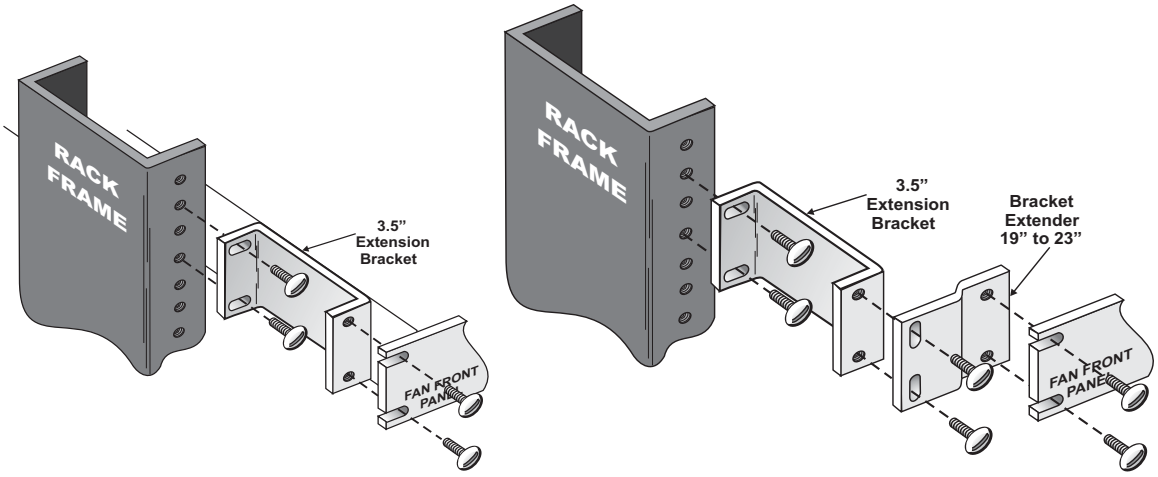


Figure 503-1. Front Mounting to a 600 mm Rack or Cabinet



a. 19” Rack or Cabinet **b. 23” Rack**

Figure 503-2. Center Mounting Assembly

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5. Position fan assembly directly above the HWX equipment shelf. Align the mounting holes, and using appropriate mounting screws, secure to rack/cabinet rails or extension brackets. Tighten the mounting screws securely.

6. Type of fan assembly:
   - For AC fan assembly, continue to step 7.
   - For DV6948FAN (-48 VDC model) go to step 8.

   Note: The 220 VAC line cord is not supplied with the 220 VAC fan assemblies.

7. Ensure that the fan on/off switch (located on the rear panel for the HXFANxxx or the front panel for the DV69xxFAN) is in the **"O"** (off) position. Connect the female end of the power cord into the IEC AC adapter on the rear panel of the assembly, and the male plug into an active AC power outlet. DO NOT turn on the fan assembly until after power has been applied to the equipment shelf.

Stop! You have completed this procedure.

8. HWX Equipment Shelf DC input power wiring configuration:
   - If a single DC input power source is used, continue to step 9.
   - If a redundant DC input power source is used, go to step 10.

9. For a single powered equipment shelf, connect either fan assembly terminal "A BATT" or "B BATT (see Figure 503-3) to the HWX Equipment Shelf rear panel's input terminal block that will be wired for -48 VDC input power (ABAT or BBAT, see Figure 503-4). To make wire connections, go to step 11.

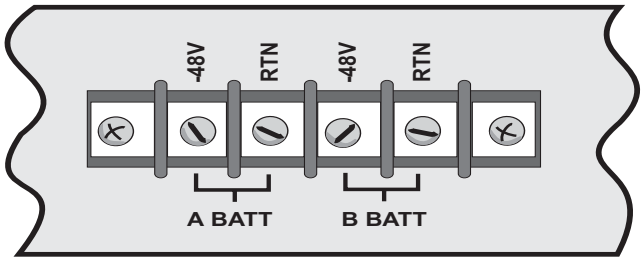

Figure 503-3. DC Fan Rear Panel

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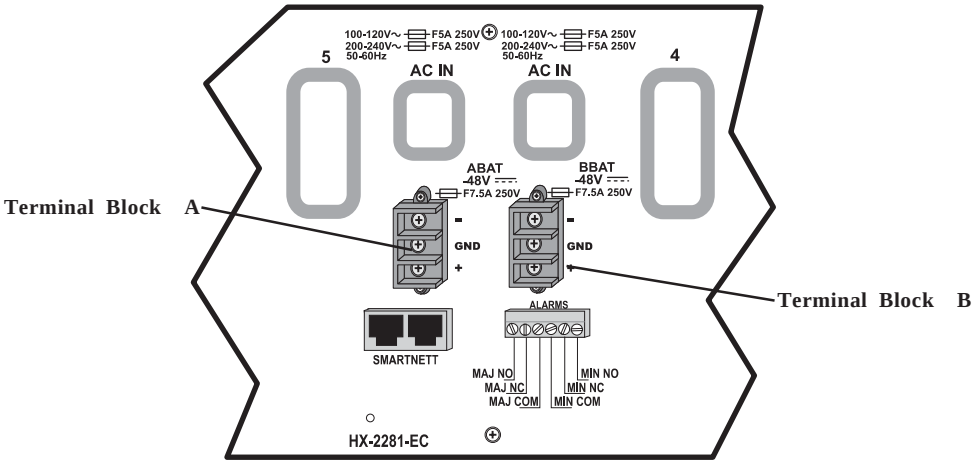

Figure 503-4. HX2281EC Equipment Shelf, Rear View

10. For a redundant powered equipment shelf, connect the fan assembly terminal "A BATT" (see Figure 503-3) to either HWX Universal Equipment Shelf's rear panel's input terminal blocks (ABAT or BBAT). Then, connect the fan assembly terminal "B BATT" to the ***other*** HWX Universal Equipment Shelf's rear panel input terminal block (see Figure 503-4). To make wire connections, continue to step 11.

Note: Do not tighten the screw terminals on the *equipment shelf's* terminal blocks. Multiple connections to these screw-terminals will be required when attaching the office DC power circuits (DLP-507).

11. Measure and cut two lengths of wire for each terminal block to be connected. Strip the insulation from the last 1/2 inch on both ends of the wire, and crimp an insulated fork/spade crimp terminal to each end. Connect wires as follows:

    a. Connect one wire from fan assembly "– 48V" screw-terminal to HWX Universal equipment shelf "**–**" screw-terminal. Only tighten fan assembly screw-terminal.

    b. Connect the remaining wire from fan assembly "RTN" screw-terminal to HWX Universal equipment shelf "+" screw-terminal. Only tighten fan assembly screw-terminal.

Note: The DC model fan assembly does not have a power switch. Power will be supplied to the fan assembly when power is applied to the equipment shelf.

12. Ensure that all wire connections are routed such that they will not come into contact with each other, the assembly chassis, or the rack/cabinet frame.

Stop! You have completed this procedure.

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INSTALLING HW-PSFAN-X-XXX INTEGRATED FAN/POWER SUPPLY

Summary: This procedure describes how to mount the HW-PSFAN-x-xxx Integrated Fan/Power Supply in a rack or cabinet (see the discussion of ventilation requirements in DLP-500); connecting office ground and wiring the -48 VDC output to the HWX equipment shelf.

Note: The HW-PSFAN-x-xxx fan assembly is required if the HWX Universal Equipment Shelf requires -48 VDC (using HX1481PC or HX3481PC Power Supply/Controllers) ***and no*** office -48 VDC primary power is available at the site.

The unit must be mounted directly above the HWX equipment shelf, and has `mounting brackets that can be reoriented so that the shelf can be mounted in ***most*** 19", 23", 24", and 600 mm (with bracket extenders) racks or cabinets. However, the mounting capabilities of the ventilation spacer assembly may negate certain mounting configurations. Reference the rack/cabinet hardware requirements listing for mounting capabilities.

Warning: *To prevent electrical shock, never install electrical equipment in a wet location or during a lightning storm.*

Caution: *The dual supply version of the Integrated Fan/Power Supply (HW-PSFAN-**2**-xxx) is designed to provide two (2) power supply sources for **one** (1) HWX Universal Equipment Shelf. **DO NOT** attempt to connect the power supply outputs to more than one equipment shelf.*

1. Obtain the following tools and equipment:
   - Flat-blade or Phillips screwdriver to match mounting screws
   - Rack/cabinet hardware requirements (quantity) to mount assembly:

LEGEND R=Rack, C=Cabinet	**19" R or C**		**24" R or C**		**Telco Ctr Mnt R**		**600mm R or C**	
Fnt=Front Mnt, Ctr=Center Mnt	**Fnt**	**Ctr**	**Fnt**	**Ctr**	**19"**	**23"**	**Fnt**	**Ctr**
HW-PSFAN-x-xxx mounts in:	Yes	Yes	**No[1]**	**No[2]**	Yes	Yes	Yes	Yes
Bracket Extenders P/N								
1RU, 19" to 600mm 002554-002							4	2
Rear Support, Right 002636-001	1						2	
Rear Support, Left 002636-002	1						2	
Binding Head Machine Screws								
10-32 or 12-24, 1/2 inch	8	4			8	4		
6mm							10	4

Note 1. Although the power supply fan assembly can be mounted in a 24" space, no 19" to 24" extender brackets exist for mounting the rear support brackets.
Note 2. The ventilation spacer assembly can not be adapted to the 24" spacing requirement.

   - Ground wire, 16 AWG (minimum), stranded conductor, length as required
   - DC power wire, 18 AWG (minimum), stranded conductor, length as required
   - Insulated fork/spade crimp terminals, to accommodate 18 AWG wire (6 if single source of power, 12 for redundant inputs)
   - Approved crimp tool

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2. Check that the shelf mounting brackets are mounted in the proper location for the rack or cabinet to be used. If necessary, remove the mounting brackets from the shelf's end plates. Reorient the brackets as required (see Figure 504-1), and reattach them to the shelf in the new orientation, reusing the original attaching screws.

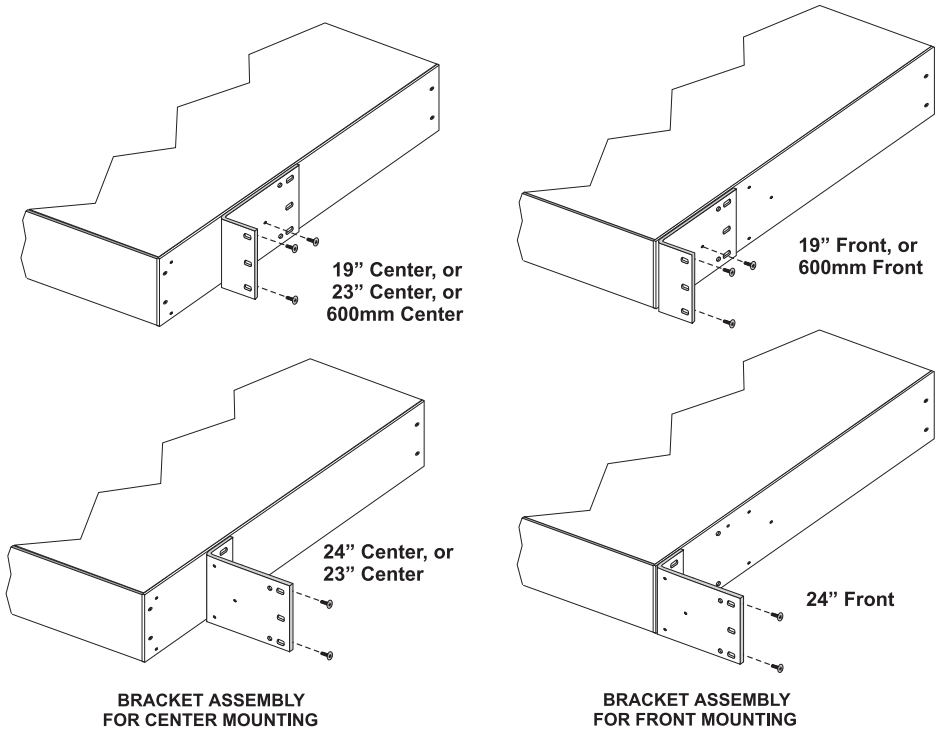

Figure 504-1. Orienting Mounting Brackets For Integrated Fan/Power Supply Mounting Options

3. If the unit is going to be placed in a 600 mm rack or cabinet:

   a. Refer to Figure 504-2 for attaching the 19" to 600 mm bracket extenders to the units front mounting brackets (one on each side).

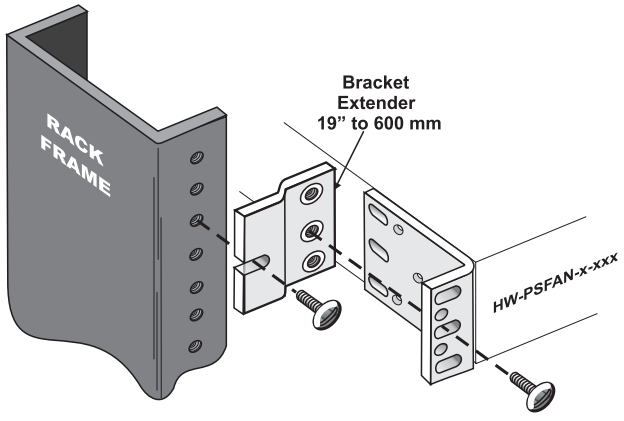

Figure 504-2. Attaching 600 mm Bracket Extender

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b. If the unit is going to be *front* mounted, refer to Figure 504-3 for attaching the 19” to 600 mm extender brackets to the right and left rear support brackets.

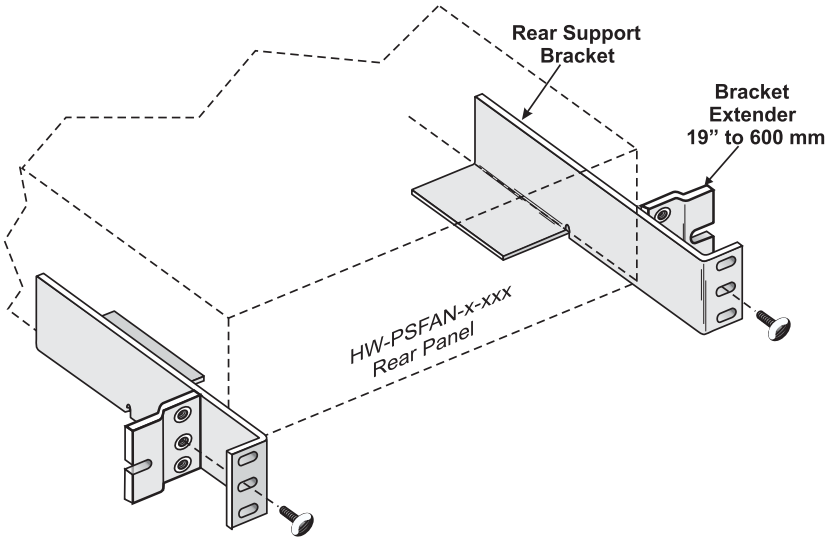

Figure 504-3. Attaching 600 mm Extender Brackets to Rear Support Brackets

4. **For front mounting only.** Position the rear support mounting brackets (right and left) on the rear rack frame in a manner that both provides side and rear support to the Fan/Power Supply (Figure 504-4), and places the bottom of the Fan/Power Supply housing directly on top of the HWX Universal Equipment Shelf for proper cooling. Mount the brackets using appropriate mounting hardware. Tighten the screws securely.

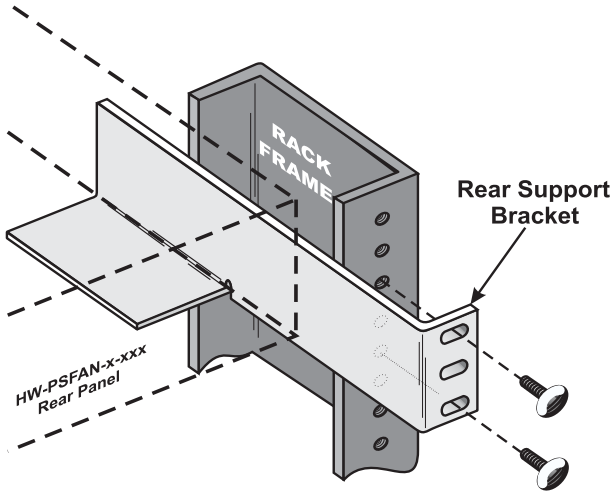

Figure 504-4. Mounting of Rear Support Brackets

Note: If mounting the assembly in a 23” rack refer to Figure 504-5 for location of mounting holes.

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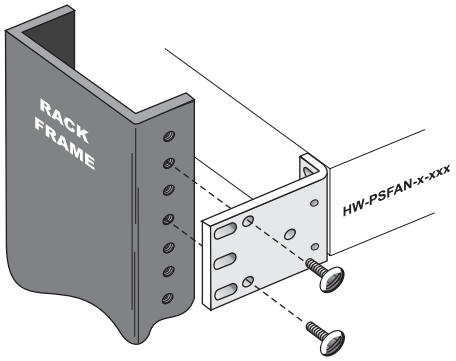

Figure 504-5. Front Mounting 23" Rack

5. Position the Fan/Power Supply in the location directly above the installed HWX shelf (if front mount, place the sides of the unit on the previously mounted rear support brackets (step 4). Align the mounting holes in the ears with the applicable holes in the rack or cabinet front rails.

6. Use appropriate mounting screws to secure the Fan/Power supply mounting brackets to the rack or cabinet rails. Tighten the mounting screws securely.

⚠ **Warning:** *Steps 7 through 9 connect the Fan/Power Supply to office ground. This connection must be made using methods and hardware that meet all applicable local and national electrical codes.*

7. Using only the length needed to reach the office ground connection point (wire length to be as short and straight as possible), cut one length of 16 AWG wire. Strip the insulation from the last 1/2 inch of wire.

8. Press the Integrated Fan/Power Supply spring-loaded ground post (see Figure 504-6) until the outer and inner sleeves are aligned so that the holes for the wire are matched, then insert one end of the stripped ground wire into the holes, and release the ground post.

9. Route the wire and connect its other end to the office ground conductor. Dress and secure the ground wire so that it cannot come into contact with any other electrical terminations.

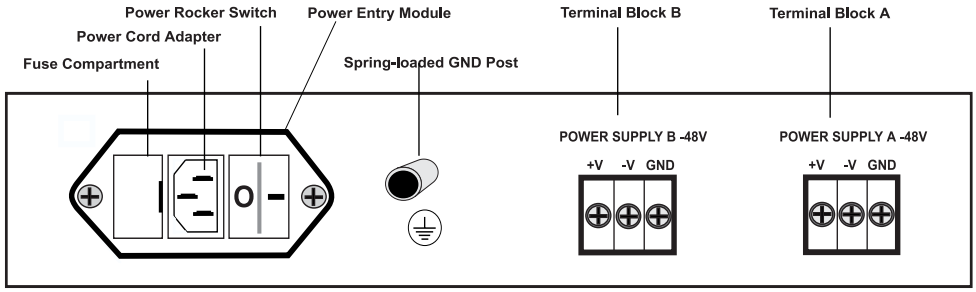

Figure 504-6. Integrated Fan/Power Supply (Dual Output Version) Rear Panel

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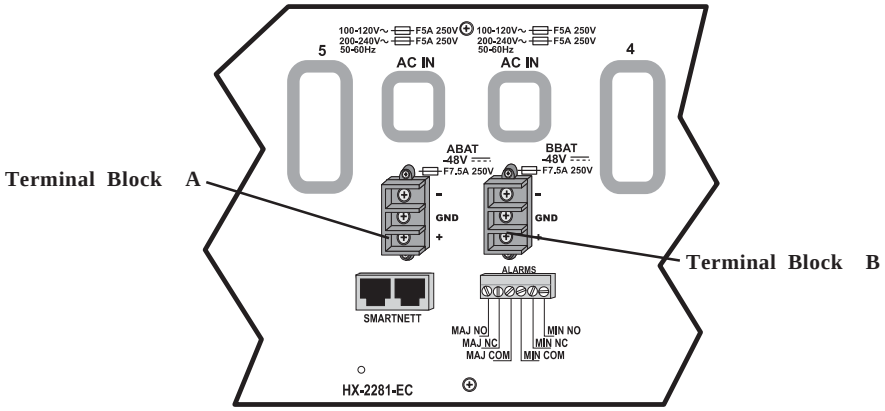

Figure 504-7. HX2281EC Equipment Shelf Rear View

Note: Steps 10 through 13 connect the -48 VDC output(s) of the Fan/Power Supply to the HWX equipment shelf input terminal blocks ABAT and/or BBAT (refer to Figures 504-6 and 504-7).

10. Single or redundant Integrated Fan/Power Supply?
    - If a **single** output supply (HW-PSFAN-**1**-xxx), continue to step 11.
    - If a **redundant** output supply (HW-PSFAN-**2**-xxx), go to step 12.

11. Connect the Fan/Power Supply terminal block "Power Supply A -48V" to the HWX Equipment Shelf rear panel's input terminal block that will be wired for -48 VDC input power (ABAT or BBAT). To make wire connections, go to step 13.

12. Connect the Fan/Power Supply terminal block "Power Supply A -48V" to either HWX equipment shelf's rear panel input terminal "ABAT" or "BBAT". Then connect the "Power Supply B -48V" terminal block to the ***other*** HWX equipment shelf rear panel input terminal block. To make wire connections, continue to step 13.

13. Measure and cut three lengths of 18 AWG wire for each terminal block to be connected. Strip the insulation from the last 1/2 inch on both ends of the wire and crimp a fork/spade crimp terminal to each end. Connect as follows:
    a. Connect one wire from the Fan/Power Supply's "–V" screw-terminal to the HWX equipment shelf's "**–**" screw-terminal, tighten screw terminal securely.
    b. Connect the second wire from the Fan/Power Supply's "+ V" screw-terminal to the HWX equipment shelf's "+" screw-terminal, tighten screw terminal securely.
    c. Connect the third wire from the Fan/Power Supply's "GND" screw terminal to the HWX equipment shelf's "GND" screw-terminal, tighten screw terminal securely.

⚠ **Warning:** *Do not connect the Fan/Power Supply AC power cord at this time.*

Stop! You have completed this procedure.

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INSTALLING HDW-100461 VENTILATION SPACER

Summary: This procedure describes how to mount the HDW-100461 Ventilation Spacer in a rack or cabinet (see the discussion of ventilation in DLP-500). An HDW-100461 Ventilation Spacer is a mechanical assembly that is required:

- On top of the topmost HWX equipment shelf fan assembly in a rack/cabinet (Figure 505-2b), or
- When an HWX equipment shelf fan assembly is mounted under another rack mounted assembly that has an air intake on the bottom of its housing (Figure 505-2a).

The ventilation spacer assembly can be reoriented so that the shelf can be mounted to all 19", 23", and 600 mm (with bracket extenders) racks or cabinets.

1. Obtain the following tools and equipment:
   - Flat-blade or Phillips screwdriver to match mounting screws
   - Rack/cabinet hardware requirements (quantity) to mount assembly:

LEGEND R=Rack, C=Cabinet		**19" R or C**		**24" R or C**		**Telco Ctr Mnt R**		**600mm R or C**	
Fnt=Front Mnt, Ctr=Center Mnt		**Fnt**	**Ctr**	**Fnt**	**Ctr**	**19"**	**23"**	**Fnt**	**Ctr**
HDW-100461 mounts in:		Yes	Yes	**No[1]**	**No[1]**	Yes	Yes	Yes	Yes
Bracket Extenders	**P/N**								
1RU, 19" to 600mm	002554-002							4	2
Rear Support, Right	002636-001	1						1	
Rear Support, Left	002636-002	1						1	
Binding Head Machine Screws									
10-32 or 12-24, 1/2 inch		8	4			8	4		
6mm								8	4

Note 1. No 19" to 24" extender brackets available.

Note: The ventilation spacer assembly (Figure 505-1) is designed so that when mounted in a rack or cabinet it will allow air to be drawn from the front of the unit and deflect it upward. Air exhausted upward, beneath this assembly, will be deflected to the rear (refer to Figure 505-2a and -2b).

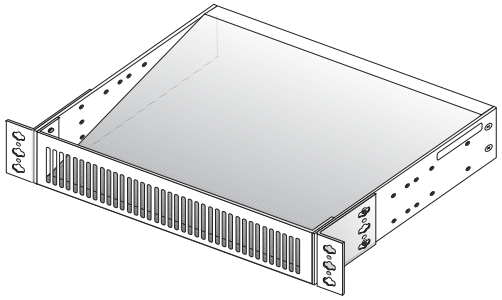

Figure 505-1. Ventilation Spacer Assembly

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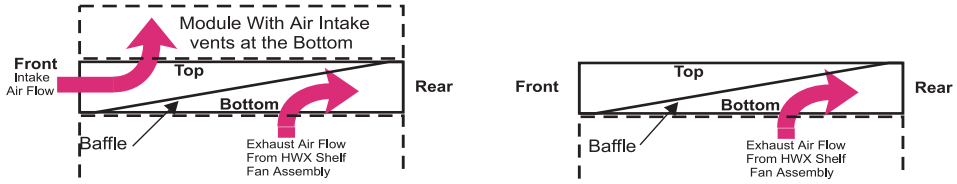
2. The unit should be oriented so that the baffle will deflect the exhaust air from the HWX shelf fan assembly beneath the unit to the rear of the equipment rack or shelf (refer to Figure 505-2b).



a. Under Mounted Assembly **b. Over Topmost HWX Shelf**

Figure 505-2. Ventilation Spacer Air Flow Diagrams

3. Check that the shelf mounting brackets are mounted in the proper location for the rack or cabinet to be used. If necessary, remove the mounting brackets from the units's end plates. Reorient the brackets as required (see Figure 505-3), and reattach them to the unit in the new orientation, reusing the original attaching screws.

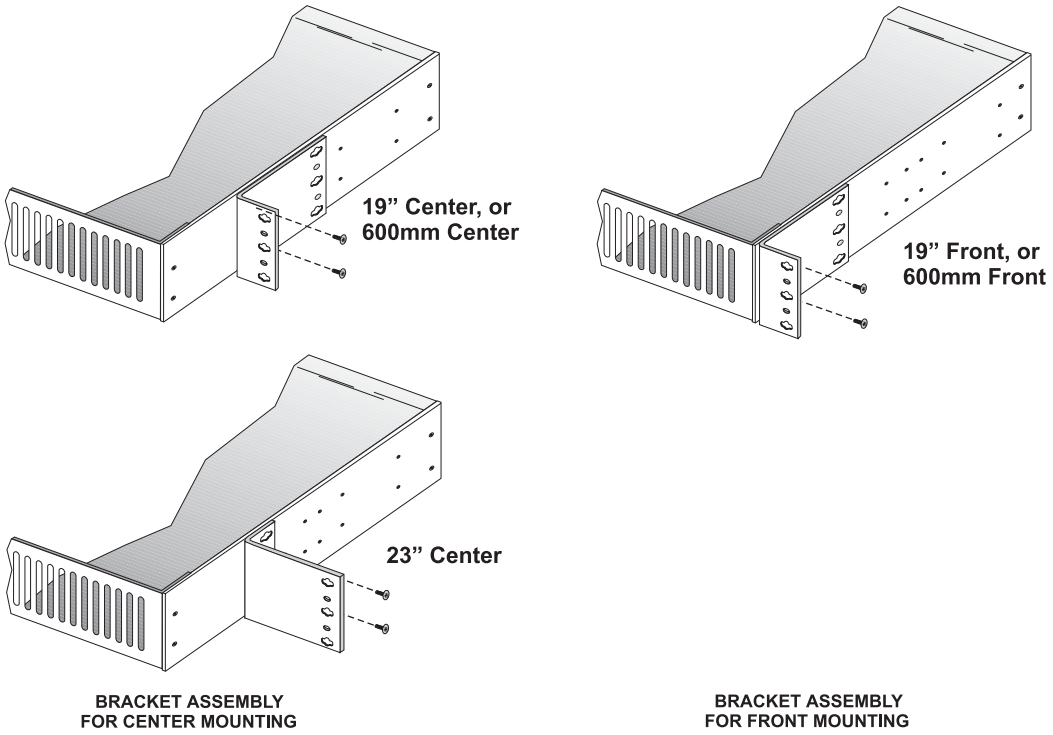

19" Center, or 600mm Center
19" Front, or 600mm Front
23" Center
BRACKET ASSEMBLY FOR CENTER MOUNTING
BRACKET ASSEMBLY FOR FRONT MOUNTING

Figure 505-3. Orienting Mounting Brackets For Ventilation Spacer Mounting Options

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4. If the shelf is going to be placed in a 600 mm rack or cabinet, refer to Figure 505-4 for installation of the 19” to 600 mm bracket extenders.

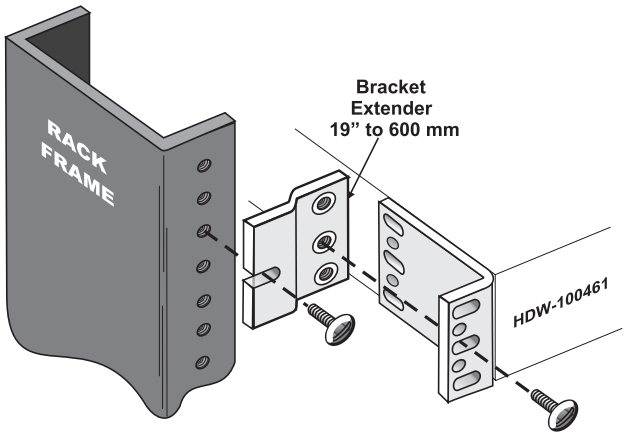

Figure 505-4. Attaching 600 mm Bracket Extender

5. Position the ventilation spacer assembly directly over the fan assembly.

6. Use the appropriate mounting screws to secure the ventilation spacer assembly to the rack frame or cabinet rails. Tighten the mounting screws securely.

Stop! You have completed this procedure.

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CONNECTING HWX UNIVERSAL EQUIPMENT SHELF TO OFFICE GROUND

Summary: This procedure establishes a ground connection between the HWX Universal Equipment Shelf and the office ground.

⚠ **Warning:** *To prevent electrical shock, never install electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following:
   - ESD wrist strap
   - Ground wire, 16 AWG, stranded conductor, length as required
   - Flat-blade or Phillips screwdriver to match mounting screws

⚠ **Caution:** *Electronic equipment can be damaged by static electrical discharge. When handling HWX-shelf units, always follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use antistatic packaging when transporting or storing units. When working on a unit, always place it on an approved, electrically grounded antistatic mat.*

2. Place the ESD wrist strap on your wrist and snap its grounding wire to the wrist band. Plug the ground plug into a grounded ESD jack.

⚠ **Warning:** *The Office Ground connection must be made using methods and hardware that meet all applicable local and national electrical codes.*

3. Using only the length needed to reach the nearest office ground connection point (wire length to be as short and straight as possible), cut one length of 16 AWG wire. Strip the insulation from the last 1/2 inch of wire.

4. Press the HWX shelf's spring-loaded ground post (see Figure 506-1) until the outer and inner sleeves are aligned so that the holes for the wire are matched, then insert the stripped end of the ground wire into the holes, and release the ground post.

5. Route the wire and connect its other end to the office ground conductor. Dress and secure the ground wire so that it cannot come into contact with any other electrical terminations.

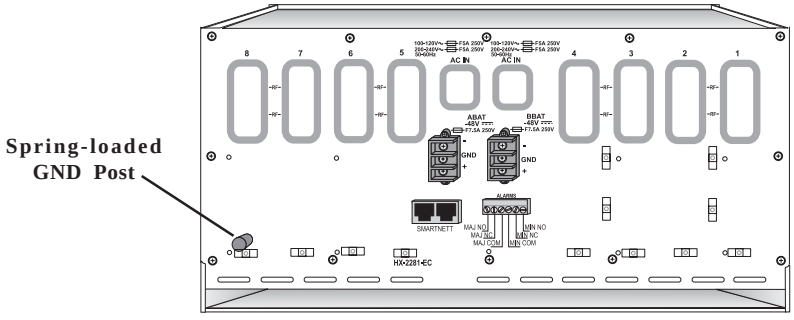

Figure 506-1. HX2281EC Shelf Rear Panel

Stop! You have completed this procedure.

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CONNECTING HWX UNIVERSAL EQUIPMENT SHELF TO OFFICE POWER PLANT

Summary: This procedure describes how to connect the office DC power source to the HWX Universal Equipment Shelf's terminal block(s).

⚠ **Warning:** *To prevent electrical shock, never install electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following:
   - ESD wrist strap
   - Power wire, 18 AWG (minimum), stranded conductor, length as required.
   - Flat-blade or Phillips screwdriver to match DC-input screw terminals.
   - Insulated fork/spade crimp terminals, to accommodate 18 AWG wire (2 for single source of power, 4 for redundant inputs)
   - Approved crimp tool

⚠ **Caution:** *Electronic equipment can be damaged by static electrical discharge. When handling HWX-shelf units, always follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use antistatic packaging when transporting or storing units. When working on a unit, always place it on an approved, electrically grounded antistatic mat.*

2. Place the ESD wrist strap on your wrist and snap its grounding wire to the wrist band. Plug the ground plug into a grounded ESD jack.

3. Be sure to isolate power to the to the -48 VDC wiring provided to the HWX shelf location. Repeat for the second -48 VDC circuit if two are to be used.

⚠ **Warning:** *Ensure that office DC power circuits are off before proceeding to step 4. Wiring provided for the -48 VDC supply must be 18 AWG minimum.*

4. Wire the HWX equipment shelf (refer to Figure 507-1):
   - If single connection (A **or** B), connect office DC circuit to the HWX Equipment Shelf rear panel's input terminal block that will be wired for -48 VDC input power, "-48VDC" (ABAT **or** BBAT). To make wire connections, continue to step 5.
   - If redundant connections (A **and** B), connect first office DC circuit to either HWX Equipment Shelf's rear panel input terminal "-48VDC" (ABAT **or** BBAT). Then connect the second office DC circuit to the ***other*** HWX Equipment Shelf's rear panel input terminal block "-48VDC". To make wire connections, continue to step 5.

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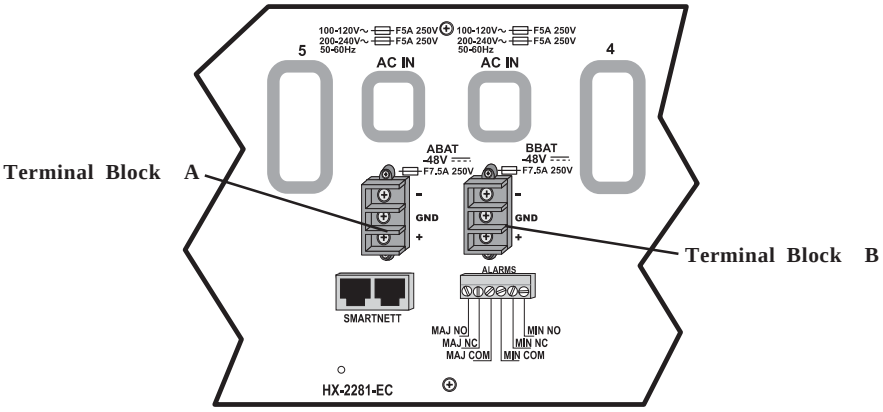

Figure 507-1. HX2281EC Equipment Shelf, Rear View

5. Connect an insulated crimp termination to the end of each office circuit wire.

Note: If using the HXFAN48 or DV6948FAN assembly, the HWX shelf terminal blocks will require two crimp terminations to be connected to each screw terminal (the wire from the fan assembly and the wire from the office DC circuit). To accomplish this, it will be necessary to place the flat side of each crimp termination together. Care should be taken to ensure that these connections do not short out to the equipment shelf's rear metal plate (refer to Figure 507-2).

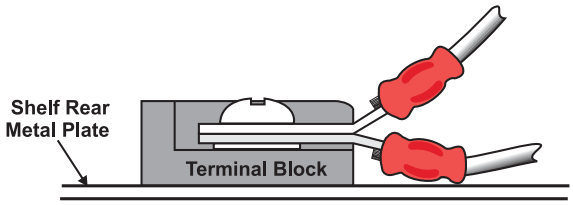

Figure 507-2. HWX Shelf Terminal Block - Two Wire Connection

6. Remove the previously installed fan crimp termination from HWX equipment shelf's "**–**" screw terminal. Place fan crimp termination and plant negative crimp termination under the HWX equipment shelf's "**–**" screw terminal (see Figure 507-2). Tighten screw terminal securely.

7. Remove the previously installed fan crimp termination from HWX equipment shelf's "+" screw terminal. Place fan crimp termination and plant return crimp termination under the HWX equipment shelf's "+" screw terminal (see Figure 507-2). Tighten screw terminal securely.

8. Dress and secure the office DC power wires in the rack/cabinet so that they cannot come into contact with any other electrical terminations or rack/cabinet frame.

Warning: *Do not apply office DC power to the HWX Equipment Shelf at this time.*

Stop! You have completed this procedure.

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CONNECTING POWER SUPPLY/CONTROLLER LOCAL ALARM RELAYS

Summary: A six-screw terminal block (Figure 508-1), on the rear panel of the HWX Universal Equipment Shelf, provides connection to local alarm devices. Alarms can be connected to local alarm devices or alarm systems to alert operators to major and minor alarm conditions. A major or minor alarm detected in the primary (master) Power Supply/Controller will activate the relays and illuminate the modules alarm LEDs. A major alarm will cause the red MAJ ALARM LED on the front panel of the Power Supply/Controller to light, and a minor alarm will cause the yellow MIN ALARM LED to light.

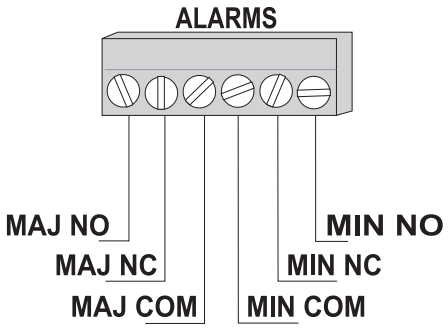

Figure 508-1. HWX Equipment Shelf ALARMS Terminal Block

1. Two alarm relays, in the Power Supply/Controller (PS/C), are accessible through the ALARMS terminal block on the rear panel of the HWX shelf. One set of three screw terminals is dedicated to major alarm conditions, and the other set of three to the minor alarm conditions. Refer to Table 508-1 to find major alarm conditions and it's associated relay contact functions and Table 508-2 for minor alarm conditions and it's associated relay contact functions.

Table 508-1. Major Alarm Relay

MAJOR ALARM RELAY **MAJ NO - Normally Open with power on, and no alarm condition** **MAJ NC - Normally Closed with power on, and no alarm condition** **MAJ COM - Common**
Major Alarm Condition on a *Primary* PS/C module
Any major alarm condition on any optional plug-in modules
Major Alarm Condition on a *Primary or* Secondary PS/C module
+24 VDC output is within major alarm threshold range
+12 VDC output is within major alarm threshold range
-12 VDC output is within major alarm threshold range

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Table 508-2. Minor Alarm Relay

MINOR ALARM RELAY **MIN NO - Normally Open with power on, and no alarm condition** **MIN NC - Normally Closed with power on, and no alarm condition** **MIN COM - Common**
Minor Alarm Condition on a *Primary* PS/C module
Any minor alarm condition on any optional plug-in modules
If a redundant PS/C module is installed, any minor ***or*** major failure in the redundant module
Minor Alarm Condition on a *Primary or Secondary* PS/C module
+24 VDC output is within minor alarm threshold range
+12 VDC output is within minor alarm threshold range
-12 VDC output is within minor alarm threshold range
- 48 VDC (A or B) is absent (on threshold -30V, off -37V), or 115 VAC is absent (on threshold 80 VAC, off 90 VAC) 220 VAC is absent (on threshold 170 VAC, off 180 VAC)
Unused - 48 VDC input terminal (A or B) enabled

2. Connect local alarm devices to the designated relay screw terminals. Relay contacts are rated for:

   10 Watts, maximum power

   200 VDC, maximum switching voltage

   0.5 Amps, maximum switching current

   200 VDC, break-down voltage between contacts

Stop! You have completed this procedure.

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INSTALLING POWER SUPPLY/CONTROLLER MODULES IN HWX SHELF

Summary: This procedure describes how to install the Power Supply/Controller modules in an HWX Universal Equipment Shelf. Only one Power Supply/Controller is required to power all other modules in a shelf, but two may be installed for redundancy. When a single supply is used, it is preferred (but not required) that it be installed in slot "P1" (left slot) rather than "P2", and a blank panel installed in the unused slot.

⚠ **Warning:** *To prevent electrical shock, never install electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following tools and equipment:
   - ESD wrist strap
   - Power Supply/Controller module(s), or
   - Blank panel (HX1281BP), if only one Power Supply/Controller is to be installed

⚠ **Caution:** *Electronic equipment can be damaged by static electrical discharge. When handling HWX-shelf units, always follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use antistatic packaging when transporting or storing units. When working on a unit, always place it on an approved, electrically grounded antistatic mat.*

2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap. Plug the ground plug into a grounded ESD jack.

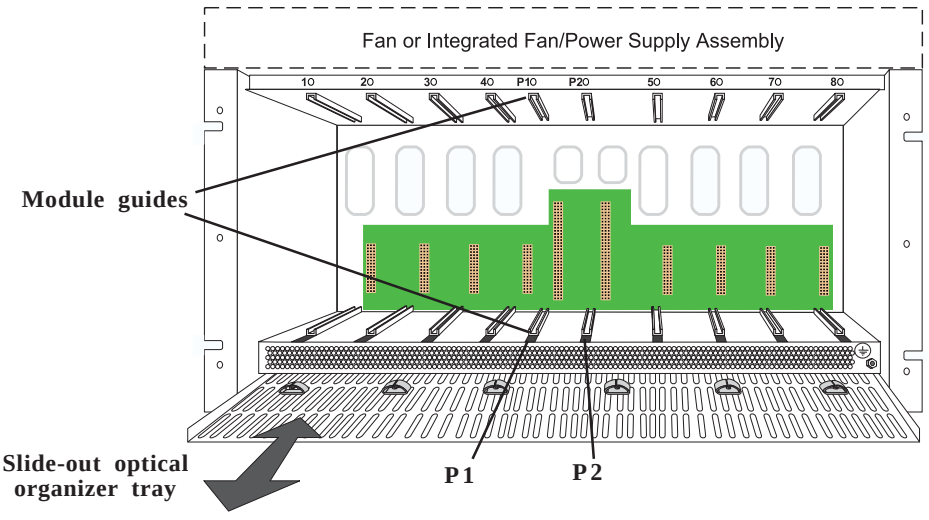

Figure 509-1. Power Supply/Controller Locations in the HWX Shelf

⚠ **Caution:** *Do not use excessive force inserting or reseating modules in the equipment shelf. Although all modules can be removed or installed while the shelf is powered (hot swap) without risk of damage or system interruption, excessive insertion force (slamming module into shelf while inserting) may cause system interruption.*

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3. Insert the primary Power Supply/Controller module into the "P1" slot in the HWX shelf, taking care to insert the top and bottom edges of the module's chassis in the guides of the shelf's module compartment (see Figure 509-1). Slide the module back until the rear of the Power Supply/Controller module just contacts the shelf's backplane connector.
4. Now firmly, but gently, fully insert (seat) the module. The top of module front panel should be flush against top shelf rail.
5. Press in the spring-loaded captive retaining screw at the top of the Power Supply/Controller module's front panel and turn it clockwise to engage the threads. Finger tighten retaining screw.
6. If applicable, place the secondary Power Supply/Controller into the "P2" slot in the HWX shelf (see Figure 509-1), repeating insertion steps 3 through 5.
7. If only one Power Supply/Controller is to be installed, cover the unused Power Supply/Network Controller slot with blank panel assembly HX1281BP. Insert the tab at the bottom of the assembly into the slot provided for it in the floor of the shelf's module compartment. Secure the panel in place with its captive retaining screw, as described in step 5.
8. Determine type of Power Supply/Controllers to be used in the equipment shelf:
   a. If using AC (HX1AC1PC or HX1AC2PC) Power Supply/Controllers, continue to step 9.
   b. If using DC (HX1481PC or HX3481PC) Power Supply/Controllers, no further action is required.

   Stop! You have completed this procedure.

Note: In step 9, DO NOT connect primary AC power to the Power Supply/Controller module(s) at this time.

9. For AC Power Supply/Controllers, route the female end of the power cord (line cord not supplied with 220 VAC version), through the cut-out in the rear of the equipment shelf. Connect it into the IEC AC adapter on the rear panel of the Power Supply/Controller module. Do not connect the male end of the cord into an AC power outlet until ready to perform initial functional checkout (DLP-511).

Stop! You have completed this procedure.

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CONNECTING LOCAL CRAFT OR REMOTE NETWORK MANAGEMENT INTERFACE

Summary: This procedure describes steps necessary to interface the device running the control software (local or remote) to the Power Supply/Controller module. This is required for monitoring all the modules in a shelf, controlling their front-panel indicators, setting reference thresholds, adjusting gain, and turning on and off lasers/receivers.

1. Obtain the following tools and equipment:
   - ESD wrist strap

⚠ **Caution:** *Electronic equipment can be damaged by static electrical discharge. When handling HWX-shelf units, always follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use antistatic packaging when transporting or storing units. When working on a unit, always place it on an approved, electrically grounded antistatic mat.*

2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap. Plug the ground plug into a grounded ESD jack.

3. Local (Craft) or remote (SMART-NETT/OSWorx Commander) network management:
   - If **remote** network management is to be used, continue to step 4.
   - If **local** Control Panel software is to be used, go to step 5.

➧ **Note:** Connector pinout information for the RS-485 (RJ-11) connection can be found in section 1.3A, Table 1-4, of this document.

4. Make a network management system RS-485 bus connection to either of the RJ-11 jacks (labelled “SMARTNETT”) on the HWX shelf’s rear panel (see Figure 510-1). The jacks are identical; two are provided for convenience in making daisy chain connections to other HWX equipment shelves to be monitored.

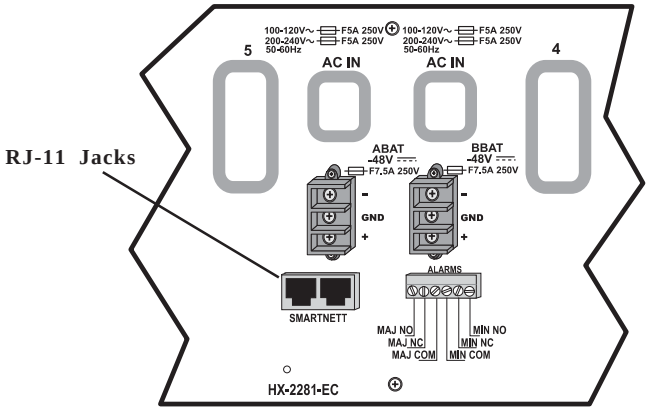

Figure 510-1. HX2281EC Equipment Shelf, Rear View

Stop! You have completed this procedure.

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Note: Connector pinout information for the RS-232 (DB-9) connection can be found in section 1.3B, Table 1-5, of this document.

5. Connect the serial port of the PC running the control software to the craft interface port labelled COMPUTER PORT (DB-9 connector) on the front panel of the primary Power Supply/Controller (blinking green POWER LED) in the HWX shelf.

6. If the Control Panel software is not already loaded on the PC, load the HWX Control Panel software included with the shelf by following the instructions in the “readme.doc” file, the “HWX Control Panel Software User Guide”, or module manuals for modules with stand-alone Control Panel Software.

Stop! You have completed this procedure.

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PERFORM INITIAL FUNCTIONAL CHECK OF HWX UNIVERSAL EQUIPMENT SHELF, FAN ASSEMBLY, AND POWER SUPPLY/CONTROLLER MODULES

Summary: This procedure covers initial power-up of an HX2281EC HWX Universal Equipment Shelf, fan assembly, and Power Supply/Controller(s). It describes how to interpret and respond to the Power Supply/Controller modules initial front-panel LED indications.

Note: In case of field failure, modules shall be replaced as a unit. No field servicing of the individual boards or components comprising the HWX system or modules shall be required. Failure to comply could result in voiding of the equipment warranty.

Warning: *To prevent electrical shock, never work on electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following tools and equipment:
   - ESD wrist strap
   - Thin bladed common screwdriver (3/16" blade width or less) to replace fuses
   - Digital voltmeter with test leads

Caution: *Electronic equipment can be damaged by static electrical discharge. When handling HWX-shelf units, always follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use antistatic packaging when transporting or storing units. When working on a unit, always place it on an approved, electrically grounded antistatic mat.*

2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap. Plug the ground plug into a grounded ESD jack.

3. Is this a new installation?
   - If **Yes**, *do not* install any optional plug-in module(s) until after the HWX shelf and Power Supply/Controller(s) have been tested and found to be operational. Go to step 5.
   - If **No**, and transmitter and/or receiver plug-in modules are already installed in the shelf, continue to step 4, adhering to the below admonishments.

Warning: *To avoid exposure to invisible laser radiation, do not look into the ends of any optical fiber or bulkhead connector. Use an optical power meter to identify active fibers. Do not assume laser power is turned off or that the fiber is disconnected at the other end.*

Warning: *Infrared radiation is invisible and can seriously damage the retina of the eye. To avoid potentially dangerous amounts of radiation exposure, a protective cap or hood MUST be immediately placed over any radiating bulkhead receptacle or optical fiber connector. This practice also keeps dirt particles from entering the connector.*

Caution: *Turn off the laser output (place Keyswitch in the OFF position) on any EDFA Amplifiers who's optical output connector is not terminated with a fiber optic cable.*

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4. Ensure that any optional plug-in modules installed in the HWX shelf are properly terminated. All transmitter fiber optic adapters should either have an outgoing fiber optic cable properly connected to them, or capped. All receiver fiber optic adapters should be properly connected or capped.

5. For ease of fault isolation, if the shelf configuration requires two (2) Power Supply/Controllers, unseat the ***secondary*** Power Supply/Controller (P2) from the shelf's backplane connector (the module does not have to be removed from the shelf).

Note: If other plug-in modules are already installed in the equipment shelf, the primary Power Supply/Controller will report their alarm condition on its major and/or minor ALARM LEDs. After applying power to the shelf, make sure there are no alarm LEDs lit on the front panels of those modules. If any of the plug-in modules are in an alarm condition, temporarily unseat them (disconnected from backplane connector). All HWX modules can be removed or installed while the shelf is powered (hot swap) with no risk of damage.

6. Read the below listed notes, then proceed to step 7.

Note: Verifying normal operation and fault diagnostics portion of this procedure is set out in a sequential table format. **Module LED Indications** column can be used as a guide to fault isolation through module LED analysis. The LED indications are shown in actual module layout positions, using the following legend:

Illuminated LED (on), the letter in the center of LED indicates the color
R = Red
G = Green
Y = Yellow

LED extinguished (out)

Note: The Power Supply/Controller normal and alarm indications are based on threshold settings that are preset during manufacturing Reference Section 1.2B, Table 1-3, "Front Panel Indicators....", and Appendix A, "Power Supply/Controller Firmware Factory Settings". Fault isolation steps are based on those settings and any user changes could yield different results.

Note: For the remainder of this procedure, if craft or remote network management software is available it should be used to verify that the module's alarm threshold settings and primary power status indications are correct. Based on telemetry readings and alarm indications, faults can then be isolated to a specific cause.

This procedure also assumes a working knowledge of the craft application software. If detail instructions are required, refer to your applicable craft software instruction manual.

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7. Apply input power to the HWX Equipment Shelf:

   a. If using **AC power**, continue to step 8.

   b. If using **Office DC power,** go to step 9.

   c. If using an **HWX Integrated Fan/Power Supply** assembly (HW-PSFAN-x-xxx) for DC power, go to step 10.

8. For ***HX1AC1PC or HX1AC2PC Power Supply/Controller(s)***, plug the male end of the Power Supply/Controller power cord into the intended AC power outlet. Repeat if a second AC module is installed. Go to step 11.

9. For ***Office DC power***, install the appropriate office fuse(s), or activate the circuits, to apply -48 VDC power to the equipment shelf. Go to step 11.

10. If using an ***HWX Integrated Fan/Power Supply*** assembly:

    a. Connect the female end of the power cord into the Power Module's IEC AC adapter on the rear panel of the assembly. Plug the male end of the cord into the intended AC power outlet.

    b. Place the power on rocker switch (on the power entry module, located on the rear panel) in the **"I"** (on) position. This will apply -48 VDC to the shelf and cooling fans. Continue to step 11.

11. If the HWX equipment shelf is configured for both AC and DC input power redundancy, repeat step 7 for the alternate power source.

12. Turn on fan assemblies:

    - If using an HXFANxxx AC fan assembly, on the *rear panel*, turn the fan on by pressing the "**I**" (on) side of the unit's power rocker switch. Go to **Table 511-1A, HXFANxxx AC Fault Diagnostic/Probable Cause**, to verify normal fan operation.

    - If using an DV69xxFAN AC fan assembly, on the *front panel*, turn the fan on by pressing the "**I**" (on) side of the unit's power rocker switch. Go to **Table 511-1B, DV69xxFAN Fault Diagnostic/Probable Cause**, to verify normal fan operation.

    - If using a *HXFAN48 or DV6948FAN* DC fan assembly, power is applied when DC voltage is connected to the unit. Proceed to Table **511-1C, HXFAN48 or DV6948FAN DC Fault Diagnostic/Probable Cause**, to verify normal fan operation.

    - If using an HWX Integrated Fan/Power Supply assembly, go to **Table 511-1D, Fan/ Power Supply Fault Diagnostic/Probable Cause**, to verify normal fan operation.

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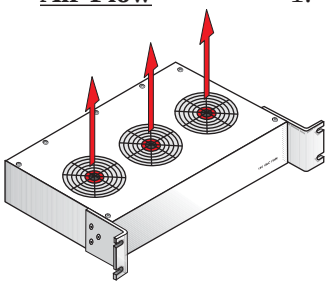
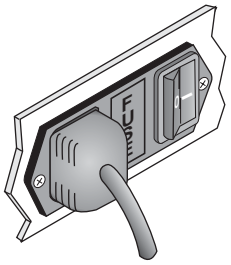
Module LED Indications	Table 511-1A HXFANxxx AC Fault Diagnostic/Probable Cause
Air Flow 	1. Verify that all three (3) fans of the fan assembly are operational and are directing air flow as intended. • If **all three fans are operational**, go **Table 511-2, Power Supply/Controller Fault Diagnostic/Probable Cause**, to verify proper Power Supply/Controller operation. • If **only one or two are operational**, place power rocker switch to the off position (O), remove the AC power cord, and return the faulty fan assembly to C-COR.net. ***DO NOT attempt to use the fan assembly in this condition!*** • If **None of the fans are operating**, continue to step 2.
	⚠ **Caution:** *Before continuing to step 2, disconnect power to the HWX Equipment Shelf until cooling air fault is diagnosed and corrected. Reconnect when complete.* 2. On the rear panel, check that the AC power rocker switch is in the **"I"** (on) position. • If **Yes**, continue to step 3. • If **No**, to turn the fan assembly on, press **"I"** (on) side of the power rocker switch. Repeat from step 1. 3. Check that the AC power cord is connected to the unit's IEC AC adapter and the male end of the power cord is connected to an active AC outlet. • If **Yes**, continue to step 4. • If **No**, connect AC power cord into the unit's AC adapter and/or an active AC power outlet. Repeat step 1. 4. Unplug male power plug from the AC outlet. Using the digital voltmeter, set controls and range to measure AC supply voltage. Check that a supply voltage of: 115 VAC: 90 to 132 VAC 220 VAC: 180 to 264 VAC is present at the AC outlet. • If the voltage **is present**, continue to step 5. • If voltage **is not present**, check AC input source. Initiate corrective action. When complete, reconnect male plug to AC outlet, then repeat procedure from step 1.

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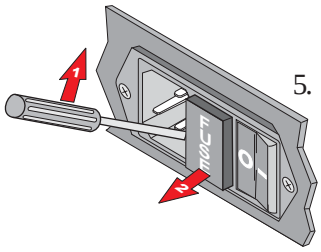
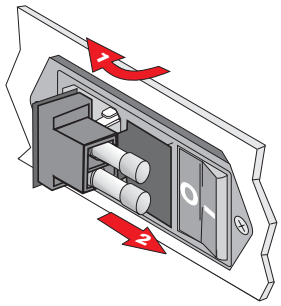
Module LED Indications

Table 511-1A (continued)
HXFANxxx AC Fault Diagnostic/Probable Cause



5. Check fuses. Place the power rocker switch in the **"O"** (off) position.

- On the power input module, place small bladed common screwdriver in the slot at the left-side of the fuse holder. Press down on the fuse holder cap to release it from the power module.



6. Flip the fuse cap holder to the left so that the fuses are exposed.

- Remove the fuses, and using the digital voltmeter, check to see if the fuses are good:
- If the fuse is ***bad*** (measures open), replace the fuse (5mm x 20mm):

  For 115 VAC: 2 Amp., 250 VAC, Slow Blow

  For 220 VAC: 1Amp., 250 VAC, Slow Blow,

Close fuse cap holder. Reconnect the power cord to the AC outlet. Place the power rocker switch in the **"I"** (on) position. Repeat procedure from step 1.

Note: If application of power to the fan assembly continues to blow fuses, suspect faulty fan assembly. Set rear panel power rocker switch to the **"O"** (off) position, disconnect AC power plug from the AC outlet and fan assembly, remove and return the suspected faulty HXFAN assembly to C-COR.net.

Stop! You have completed this procedure.

- If the fuse is ***good*** (measures continuity), suspect faulty fan assembly. Disconnect AC power plug from the AC outlet and fan assembly, remove and return the suspected faulty HXFAN assembly to C-COR.net.

Stop! You have completed this procedure.

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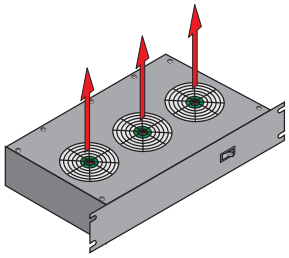
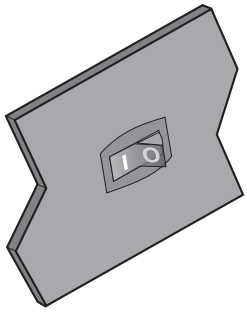
Module LED Indications	Table 511-1B DV69xxFAN AC Fault Diagnostic/Probable Cause
Air Flow 	1. Verify that all three (3) fans of the fan assembly are operational and are directing air flow as intended. • If **all three fans are operational**, go **Table 511-2, Power Supply/Controller Fault Diagnostic/Probable Cause**, to verify proper Power Supply/Controller operation. • If **only one or two are operational**, place power rocker switch to the off position (**O**), remove the AC power cord, and return the faulty fan assembly to C-COR.net. ***DO NOT attempt to use the fan assembly in this condition!*** • If **None of the fans are operating**, continue to step 2.
	⚠ **Caution:** *Before continuing to step 2, disconnect power to the HWX Equipment Shelf until cooling air fault is diagnosed and corrected. Reconnect when complete.* 2. On the front panel, check that the AC power rocker switch is in the **"I"** (on) position. • If **Yes**, continue to step 3. • If **No**, to turn the fan assembly on, press **"I"** (on) side of the power rocker switch. Repeat step 1. 3. On the rear panel, check that the AC power cord is connected to the unit's IEC AC adapter and the male end of the power cord is connected to an active AC outlet. • If **Yes**, continue to step 4. • If **No**, connect AC power cord into the unit's AC adapter and/or an active AC power outlet. Repeat step 1. 4. Unplug male power plug from the AC outlet. Using the digital voltmeter, set controls and range to measure AC supply voltage. Check that a supply voltage of: 115 VAC: 90 to 132 VAC 220 VAC: 180 to 264 VAC is present at the AC outlet. • If the voltage **is present**, continue to step 5. • If voltage **is not present**, check AC input source. Initiate corrective action. When complete, reconnect male plug to AC outlet, then repeat procedure from step 1.

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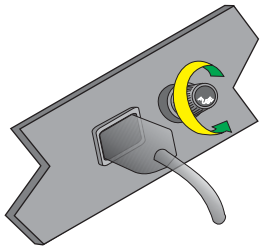
Module LED Indications	Table 511-1B (continued) DV69xxFAN AC Fault Diagnostic/Probable Cause



5. Place the power rocker switch in the **"O"** (off) position. On the rear panel, press down on the fuse holder cap and turn counterclockwise. Remove the fuse.
6. Using the digital voltmeter, check to see if the fuse is good:
   - If the fuse is ***bad*** (measures open), replace the fuse (3AG):

     For 115 VAC: 4 Amp., 250 VAC, Slow Blow

     For 220 VAC: 1 Amp., 250 VAC, Slow Blow

     Reconnect the power cord to the AC outlet. Place the power rocker switch in the **"I"** (on) position. Repeat procedure from step 1.

     Note: If application of power to the fan assembly continues to blow fuses, suspect faulty fan assembly. Set front panel power rocker switch to the **"O"** (off) position, disconnect AC power plug from the AC outlet and fan assembly, remove and return the suspected faulty DV69xxFAN assembly to C-COR.net.

     Stop! You have completed this procedure.

   - If the fuse is ***good*** (measures continuity), suspect faulty fan assembly. Disconnect AC power plug from the AC outlet and fan assembly, remove and return the suspected faulty DV69xxFAN assembly to C-COR.net.

     Stop! You have completed this procedure.

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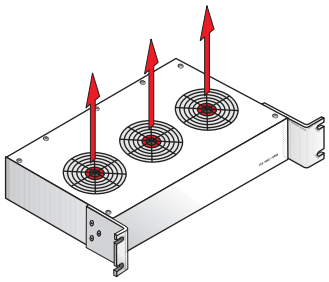
Module LED Indications	Table 511-1C HXFAN48 or DV6948 DC FAN Fault Diagnostic/Probable Cause
Air Flow 	1. Verify that all three (3) fans of the fan assembly are operational and are directing air flow as intended. • If **all three fans are operational**, go **Table 511-2, Power Supply/Controller Fault Diagnostic/Probable Cause**, to verify proper Power Supply/Controller operation. • If **only one or two are operational**, disconnect wiring, and return the faulty fan assembly to C-COR.net. ***DO NOT attempt to use the fan assembly in this condition!*** • If **None of the fans are operating**, continue to step 2. ⚠ **Caution:** *If fan assembly requires replacing, disconnect power to the HWX Equipment Shelf until replacement fan is installed. Reconnect when complete.* 2. Using the digital voltmeter, observing the marked polarity, check that a supply voltage of -40 to -56.7 VDC is present at the input terminals on the rear panel of the fan assembly. • If voltage **is not present**, check wiring and/or -48 VDC input source is turned on. Initiate corrective action. When complete, repeat procedure from step 1. • If the voltage **is present**, turn off -48 VDC source, disconnect wiring, remove and return the suspected faulty DC fan assembly to C-COR.net. **Stop! You have completed this procedure.**

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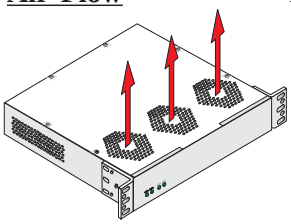
Module LED Indications	Table 511-1D Fan/Power Supply Fault Diagnostic/Probable Cause

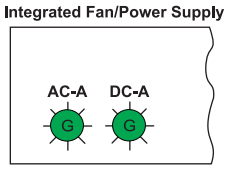
Air Flow



1. **Verify that all three (3) fans of the fan assembly are operational and are directing air flow as intended.**
   - If **all three fans are operational**, proceed to step 2.
   - If **only one or two are operational**, place power rocker switch to the off position (O), remove the AC power cord, and return the faulty fan assembly to C-COR.net.

     DO NOT attempt to use the fan assembly in this condition!
   - If **None of the fans are operating**, continue to step 3.

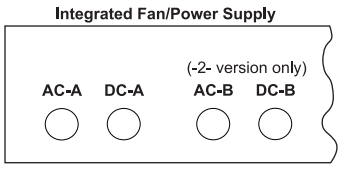
Normal Power Supply Operation



2. The AC-A and DC-A LEDs (and the AC-B and DC-B LEDs for a dual supply assembly) should be illuminated *green*.
   - If **No**, continue to step 3.
   - If **Yes**, turn the unit off. On the AC power input module, on the rear panel, set power rocker switch to the **"O"** (off) position, unplug the AC power cord from the AC outlet and then the unit, return the suspected faulty Integrated Fan/Power Supply unit to C-COR.net.

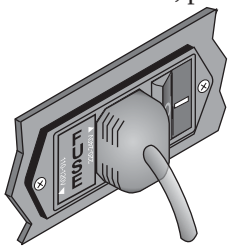
     Stop! You have completed this procedure.

Power Fault



AC Input Power

3. On the AC power input module, on the rear panel, verify that the power rocker switch is in the **"I"** (on) position.
   - If **Yes**, continue to step 4.
   - If **No**, place the power rocker switch to the **"I"** (on) position. Repeat step 1.



4. On the AC power input module, check that the AC power cord is connected to the unit's IEC AC adapter ***and*** the male end of the power cord is connected to an active AC outlet.
   - If **Yes**, continue to step 5.
   - If **No**, connect AC power cord into the unit's AC power entry module adapter and/or the AC power outlet. Repeat step 1.

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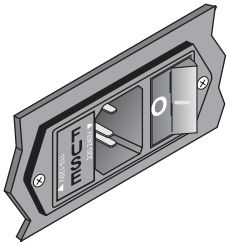
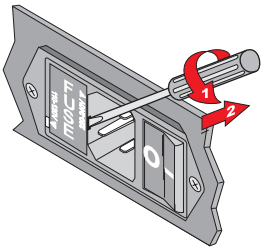
Module LED Indications

Table 511-1D (continued)
Fan/Power Supply Fault Diagnostic/Probable Cause

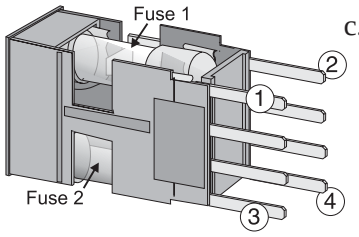
5. Unplug male power plug from the AC outlet. Using the digital voltmeter, set controls and range to measure 115 VAC. Check that a supply voltage of 90 to 130 VAC (180-246 VAC) is present at the AC outlet.
   - If voltage **is not present**, check AC input source. Initiate corrective action, correct problem, then repeat from step 1.
   - If the voltage **is present**, continue to step 6.



6. Check AC fuses:
   a. On the rear panel, set power rocker switch to the "**O**" (off) position. Remove the AC power cord from the power entry module.



   b. Next, remove the fuseholder assembly from the power entry module by inserting a small bladed common screwdriver in the slot located on the right side of the fuseholder assembly (in the IEC power cord receptacle cavity).
      1. Rotate the screwdriver 1/4-turn to start release.
      2. Press down on the screwdriver until the fuseholder snaps free from the power entry module. Use your fingers to remove the fuseholder assembly from the power entry module.



   c. Position fuseholder so that the open side (see illustration) is accessible. Using a digital voltmeter, check continuity between pins 1 and 2 (top two pins) for Fuse 1 and pins 3 and 4 (bottom two pins) for Fuse 2, to verify condition of the fuses.
      - If either or both fuses are ***bad*** (measures open), replace defective fuses (steps 7 and 8). Refer to HWX Integrated Fan/Power Supply Installation Instruction Manual for fuse type. When complete, repeat procedure from step 1.

        Note: If application of power to the fan assembly continues to blow fuses, suspect faulty fan assembly. Remove and return the suspected faulty HW-PSFAN-x-xxx assembly to C-COR.net.
      - If the fuse are ***good*** (measures continuity), replace fuseholder as directed in step 8. When complete, continue to step 9.

        Note: The fuseholder has safety compartments on both sides to prevent accidental contact with the fuses before the fuseholder pins are fully disengaged from the AC input power pins.

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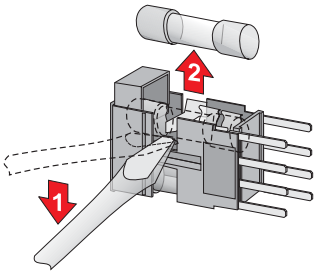
Module LED Indications | **Table 511-1D** (continued) **Fan/Power Supply Fault Diagnostic/Probable Cause**

7. To replace the fuses in the fuseholder:

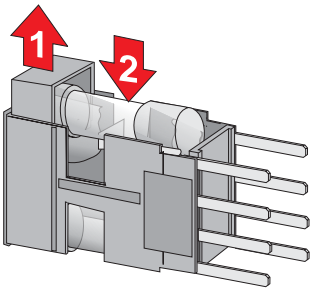


a. *To remove the fuses* from the fuseholder, hold the fuse holder so that the open side (see illustration) is accessible:

   1. Place the flat portion of the screwdriver under the fuse to be removed.
   2. Press down so as to release the fuse from the fuse clips.

      Note: As the fuse is forced upward, the safety compartment will slide up so that the fuse can be removed.

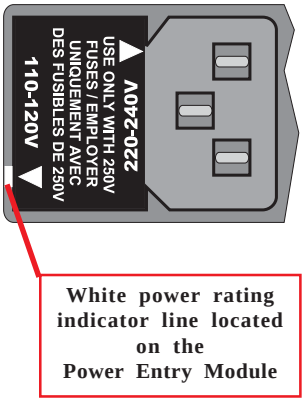
   3. Repeat step 7a if the second fuse has to be replaced.



b. *To replace the fuses* back into the fuseholder:

   1. Lift fuseholder safety compartment so that the fuse can be placed on the fuse clips.
   2. Place fuse on front (under safety compartment) and back fuse clips, then snap down into place. The safety compartments will drop down into the body of the fuseholder assembly. Repeat step 7b if the second fuse had to be replaced.

8. To replace the fuseholder back into the Fan/Power Supply AC input power module:


110-120V
220-240V
USE ONLY WITH 250V FUSES / EMPLOYER UNIQUEMENT AVEC DES FUSIBLES DE 250V
White power rating indicator line located on the Power Entry Module

a. Making sure to observe proper insertion position of the fuseholder assembly (based on input AC voltage rating), slide fuseholder assembly back into the power entry module.

   - If using 115 VAC (Models HW-PSFAN-x-110), rotate the fuseholder until the 110-120V triangular symbol on the top of the fuseholder is pointing to the white line located at the bottom-left side of the power entry module (as shown in the illustration).
   - If using 220 VAC (Models HW-PSFAN-x-220), rotate the fuseholder until the 220-240V triangular symbol on the top of the fuseholder is pointing to the white line located at the bottom-left side of the power entry module.

b. Snap the fuseholder back into the power entry module. Return to the step that initiated this action.

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Module LED Indications	Table 511-1D (continued) Fan/Power Supply Fault Diagnostic/Probable Cause

DC-A Power Supply Failure

9. Indicates the primary power supply (DC-A), which provides the power to all the front panel LEDs, has failed. Reconnect the AC power cord to the Fan/Power Supply assembly ***and*** insert the male plug into the AC outlet. Set the power rocker switch to the **"I"** (on) position. On the rear panel of the fan/power supply assembly, using the digital voltmeter (observing the marked polarity) check that a supply voltage of -40 to -56.7 VDC is present at the DC output terminals (POWER SUPPLY A - 48V and B if a dual supply version).

⚠ **Warning:** *The internal AC/DC power modules contained in the Fan/Power Supply assembly has overvoltage and thermal protection circuitry. I**f it is suspected that the assembly has overheated**, power to the assembly must be removed, and the unit allowed to cool down before it can be turned on again. **Turning the Fan/Power Supply assembly off will remove power to the equipment shelf thereby eliminating any communications to and from the shelf.** This procedure should only be performed on new installs (prior to going on-line) or after an alternate source of power has been supplied to an active shelf.*

- If a *single* supply version (DC-A only), and voltage **is not present**, suspect defective power supply. Set the power rocker switch to the "**O**" (off) position, disconnect the AC power cord from the AC outlet and the Fan/Power Supply assembly, disconnect the wiring to the shelf, remove and return the suspected faulty Integrated Fan/Power Supply assembly to C-COR.net.

  Stop! You have completed this procedure.

- If a *dual* supply version, and voltage **is not present** on DC-A **but is present** on DC-B, suspect defective assembly power supply A. Although the assembly can still be used to power the HWX Equipment Shelf, the redundancy feature no longer exists. The unit should be replaced and returned to C-COR.net for repair at the earliest convenient time.

  Continue to Table 511-2 to verify proper operation of the HWX Equipment Shelf and Power Supply/Controllers.

  Stop! You have completed this procedure.

- If the voltage **is present** on DC-A and DC-B (dual supply version), suspect defective LED or alarm circuitry. Although this will not affect functionality of the assembly, the unit should be replaced and returned to C-COR.net for repair at the earliest convenient time.

  Continue to Table 511-2 to verify proper operation of the HWX Equipment Shelf and Power Supply/Controllers.

Stop! You have completed this procedure.

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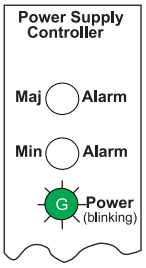
Module LED Indications	Table 511-2 Power Supply/Controller Fault Diagnostic/Probable Cause

Normal Operation

⚠ **Caution:** *Do not use excessive force inserting or reseating modules in the equipment shelf. Although all modules can be removed or installed while the shelf is powered (hot swap) without risk of damage or system interruption, excessive insertion force (slamming modules into shelf on insertion) may cause system interruption.*

Verify normal operation of the Power Supply/Controller(s)



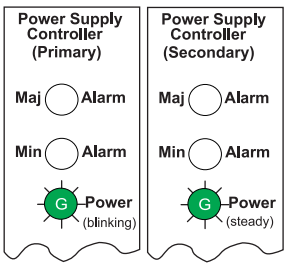
1. Unseat the primary Power Supply/Controller. Reseat the unit and observe that the following LED indications occur:
   - The *red* MAJ ALARM, *yellow* MIN ALARM, and *green* POWER LEDs all illuminate (**LED test**).
   - After approximately 3 seconds, the MAJ and MIN ALARM LEDs go *out*, and
   - The *green* POWER LED will start ***blinking***.

2. Are all observed LED indications normal, as outlined in step 1?
   - If **No**, go to step 7, or proceed to the LED pattern in this Table that corresponds to actual Power Supply/Controller fault LED pattern.
   - If **Yes**, the primary Power Supply/Controller is operational, continue to step 3.

3. HWX shelf Power Supply/Controller configuration:
   - For a single (1) Power Supply/Controller.

     Stop! You have completed this procedure.
   - If the shelf configuration has a secondary (redundant) Power Supply/Controller, continue to step 4.

4. With a known good primary Power Supply/Controller module installed in the shelf (slot P1), reseat the secondary Power Supply/Controller (slot P2). Observe that the following indications occur:



   a. On the **secondary** Power Supply/Controller:
      - The *red* MAJ ALARM, *yellow* MIN ALARM, and *green* POWER LEDs all illuminate (**LED test)**. After approximately 3 seconds,
      - The MAJ and MIN ALARM LEDs go *out*, and
      - The *green* POWER LED *illuminates* ***(steady)***.

   b. On the **primary** Power Supply/Controller:
      - The *red* MAJ and *yellow* MIN ALARM LEDs remain extinguished, and
      - The *green* POWER LED continues ***blinking***.

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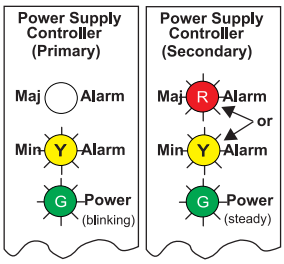
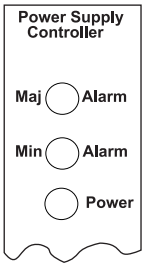
Module LED Indications	Table 511-2 (continued) Power Supply/Controller Fault Diagnostic/Probable Cause
	5. Are all observed LED indications normal, as outlined in step 4? • If **No**, continue to step 6, or proceed to the LED pattern in this Table that corresponds to actual ***secondary*** Power Supply/Controller fault LED pattern. • If **Yes**, the secondary Power Supply/Controller is operational. **Stop! You have completed this procedure.**
Secondary Failure	***Major and/or Minor Alarms in the Secondary Controller***
	6. A major and/or a minor alarm exists in the secondary Power Supply/Controller that will cause a ***minor*** *alarm in the primary* Power Supply/Controller. Fault isolate the problem in the **secondary** Power Supply/Controller starting with step 7.
No LEDs Lit	***Input Primary Power Problems***
	Note: The HX3481PC (DC Power Supply/Controllers) and the HX1AC1PC or HX1AC2PC (AC Power Supply/Controllers) will automatically shut off the input voltage to its DC converters if the input power transitions below a low voltage input limit. This LED pattern will also occur if there is no +12 VDC available on the backplane.
	7. Are all the LEDs extinguished? • If **No**, go to step 13. • If **Yes**, based on type of Power Supply/Controller: - HX1481PC (DC version), continue to step 8. - HX3481PC (DC version), continue to step 9. - HX1AC1PC or HX1AC2PC (AC version), go to step 10. 8. Using the digital voltmeter, observing the marked polarity, check that a supply voltage of -40 to -56.7 VDC is present at the active power input terminal blocks (ABAT and/or BBAT) on the rear panel of the shelf. • If voltage ***is not present or within the specified range***, initiate corrective action. After the problem has been corrected, repeat procedure from **Table 511-1** to verify that the cooling fans are still operational. • If the voltage **is present**, either the shelf backplane is defective or the Power Supply/Controller module is faulty. Call C-COR.net for direction. **Stop! You have completed this procedure.**

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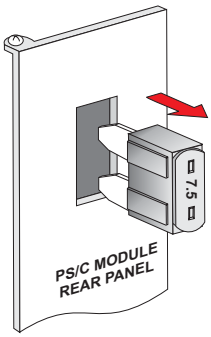
Table 511-2 (continued)

Module LED Indications	Power Supply/Controller Fault Diagnostic/Probable Cause
No LEDs Lit (continued)	9. The HX3481PC will automatically shut off input power at -30 VDC, and then back on at -37.5 VDC. Using the digital voltmeter, observing the marked polarity, check that a supply voltage of -40 to -56.7 VDC is present at the active power input terminal blocks (ABAT and/or BBAT) on the rear panel of the shelf. • If voltage ***is not present or within the specified range***, initiate corrective action. After the problem has been corrected, repeat procedure from **Table 511-1** to verify that the cooling fans are still operational. • If the voltage **is present**, a. Remove the Power Supply/Controller from the equipment shelf. - If newer version HX3481PC with an external fuse (located in the rear panel), continue to step 9b. - If HX2481PC or older version HX3481PC with no external fuse, either the shelf backplane is defective or the Power Supply/Controller module is faulty. Call C-COR.net for direction. **Stop! You have completed this procedure.**  b. Remove the fuse from the fuseholder protruding from the top-rear of the module. Using the digital voltmeter, check continuity to see if the fuse is good: • If the fuse is ***bad*** (measures open), replace the fuse (refer to HWX rear panel or Section 1.4, Table 1-7 for fuse rating). Replace module back into the equipment shelf, then repeat Table 511-2. **Note:** If application of power to the Power Supply/Controller continues to blow fuses, suspect faulty Power Supply/Controller. Suspected faulty Power Supply/Controller to C-COR.net. **Stop! You have completed this procedure.** • If the fuse is ***good*** (measures continuity), either the shelf backplane is defective or the Power Supply/Controller module is faulty. Call C-COR.net for direction. **Stop! You have completed this procedure.**

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Module LED Indications	Table 511-2 (continued) Power Supply/Controller Fault Diagnostic/Probable Cause

10. The HX1AC1PC or HX1AC2PC will automatically shut off and turn back on at set levels:

Model No.	Shuts Off	Turns On
HX1AC1PC	80 VAC	90 VAC
HX1AC2PC	170 VAC	180 VAC

Check that the AC power cord is connected to the Power Supply/Controller ***and*** inserted in an active AC outlet.

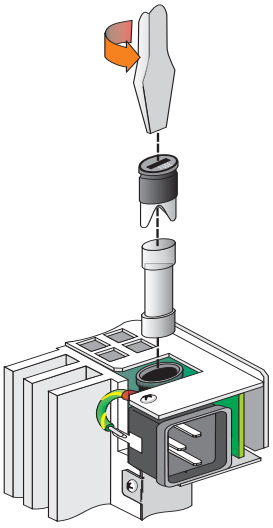
- If **Yes**, continue to step 11.
- If **No**, connect AC power cord. Repeat Table 511-2.

11. Unplug male power plug from the AC outlet. Using the digital voltmeter, set controls and range to measure AC voltage. Check that a supply voltage is present at the AC outlet:

    - HX1AC1PC, 90 to 132 VAC
    - HX1AC2PC, 180 to 264 VAC

- If voltage **is not present**, check AC input source. Initiate corrective action, then repeat Table 511-2 after the problem is corrected.
- If the voltage **is present**, continue to step 12.

12. Remove power cord from the rear of the power Supply/Controller. Remove the Power Supply/Controller from the equipment shelf. Remove fuse from the fuseholder located at the top-rear of the module. Using the digital voltmeter, check continuity to see if the fuse is good:



- If the fuse is ***bad*** (measures open), replace the fuse (refer to HWX rear panel or Section 1.4, Table 1-7 for fuse type). Replace module back into the equipment shelf, reconnect the power cord to the module, insert the power cord plug back into the AC outlet, then repeat Table 511-2.

  Note: If application of power to the Power Supply/Controller continues to blow fuses, suspect faulty Power Supply/Controller. Disconnect AC power plug from the AC outlet and Power Supply/Controller, remove and return the suspected faulty Power Supply/Controller to C-COR.net.

  Stop! You have completed this procedure.

- If the fuse is ***good*** (measures continuity), suspect faulty Power Supply/Controller. Disconnect AC power plug from the AC outlet and Power Supply/Controller, remove and return the suspected faulty Power Supply/Controller to C-COR.net.

  Stop! You have completed this procedure.

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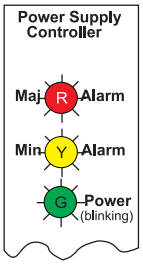
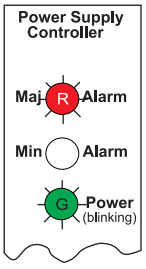
Module LED Indications	Table 511-2 (continued) Power Supply/Controller Fault Diagnostic/Probable Cause
Multiple Alarms 	***Simultaneous Major and Minor Alarms*** 13. Is the Power Supply/Controller MAJ ALARM LED *red* and the MIN ALARM LED *yellow*? • If **No**, continue to step 14. • If **Yes**, both major and minor alarms exist. First fault analyze as a major alarm, as corrective action may also clear the minor alarm(s). Continue with step 14.
Major Alarm 	**Note**: A major alarm can be caused by any of the +24, +12, or -12 VDC module DC converter outputs falling outside the Major Alarm threshold settings. The module's front panel test points indicate the voltage present on the *backplane* of the shelf. Local craft or remote network management software must be used to determine the output voltage of the module DC converters. ***Module DC converter is not within Major Threshold Settings*** 14. Is the Power Supply/Controller MAJ ALARM LED *red*? • If **No**, go to step 17. • If **Yes**, continue to step 15. 15. Using craft software, verify actual voltage values and threshold settings? • If craft software is not available, go to step 16. • If *values* are *correct*, **but** *threshold* settings are **incorrect**, reenter proper threshold settings, and repeat Table 511-2. • If *value* and *threshold* settings **are correct**, go to step 16. • If *values* are **incorrect**, go to step 16. 16. Measure Power Supply/Controller front panel Test Points (backplane voltages). Using the digital voltmeter, observing the marked polarity, check that these voltages are within specification. +24V (±10%): 21.6 to 26.4 VDC ±12V (±5%): 11.4 to 12.6 VDC • If voltages are **correct**, suspect defective Power Supply/Controller fault circuitry. Remove and return the faulty module to C-COR.net. **Stop! You have completed this procedure.**

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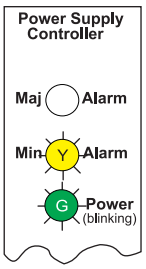
Module LED Indications	Table 511-2 (continued) Power Supply/Controller Fault Diagnostic/Probable Cause
Major Alarm (continued)	• If voltages are **incorrect**, suspect defective Power Supply/Controller or defective HWX Equipment Shelf backplane. If a second Power Supply/Controller module is available, remove and replace the Power Supply/Controller to isolate the problem. - If the fault is **cleared**, remove and return the faulty Power Supply/Controller module to C-COR.net. - If the fault **remains**, suspect defective shelf. Remove all plug-in modules. If using a DC source, turn off DC source, disconnect wiring, remove and return the faulty HWX Equipment Shelf to C-COR.net. **Stop! You have completed this procedure.**

Minor Alarm

Note: A minor alarm can be caused if any of the +24, +12, or -12 VDC module converter outputs falling outside the Minor Alarm threshold settings; if using DC input power, an *unused* -48 VDC input terminal (ABAT or BBAT) on the shelf is *enabled*, or -48 VDC input voltage below specification; if using AC input power, input voltage below specification or AC line cord not connected.

17. Is the Power Supply/Controller MAJ ALARM LED *out and the* MIN ALARM LED *yellow*?
    - If **No**, **Stop! You have completed this procedure.**
    - If **Yes**, type of input power:
      - If -48 VDC power (HX1481PC or HX3481PC Power Supply/Controllers), continue to step 18.
      - If AC Power Supply/Controller (HX1AC1PC or HX1AC2PC) go to step 23.



Monitoring a -48 VDC Input Terminal that is not enabled.

Note: Power Supply/Controllers are shipped from the factory with both Battery "A" and "B" monitor sources enabled

18. Is the shelf wired for redundant -48 VDC input power (shelf terminal blocks ABAT and BBAT wired)?
    - If **No**, continue to step 19.
    - If **Yes**, the Battery A and B enable settings will not cause this fault. Go to step 20.

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Module LED Indications	Table 511-2 (continued) Power Supply/Controller Fault Diagnostic/Probable Cause

19. Using craft software, verify that the proper -48 VDC input terminal block is enabled (A or B).
    - If **correct** terminal block (A or B) is selected **and** the input is within specification (corresponding **A OK** or **B OK** radio button is ***dark***), the fault was not caused by the DC input. Continue to next possible symptom.
    - If **correct** terminal block (A or B) is selected **but** the input is ***not*** within specification (corresponding **A OK** or **B OK** radio button is ***clear***), continue to step 20.
    - If **incorrect** terminal block is selected, enable correct terminal block (refer to *"HWX Control Panel Software User Guide")*. Repeat Table 511-2.

-48 VDC input power is not within specification.

20. Using the digital voltmeter (observing the marked polarity) check that a supply voltage between -40 to -56.7 VDC is present at the power input terminal blocks (ABAT and/or BBAT) on the rear panel of the shelf. For dual voltage inputs, check both terminal blocks.
    - If voltage **is not** present or within the specified range, fault analyze DC input source. Repeat Table 511-2 after the problem has been corrected.
    - If the specified voltage **is** present and within specified range, continue to step 21.

21. For HX2481PC or HX3481PC (without external fuse):

    Remove and reinstall the Power Supply/Controller module to make sure its connector is mating positively with the backplane connector. Recheck the MIN ALARM LED.
    - If it is **extinguished**, repeat Table 511-2.
    - If it is **still illuminated**, the Minor Alarm LED did not go out, this was not the cause of the problem. Continue to next possible symptom, step 26.

22. For HX3481PC (with external fuse):

    Check AC power supply controllers using step 9.

AC input power is not within specification.

23. Check that the AC power cord is connected to the Power Supply/Controller ***and*** inserted in an active AC outlet.
    - If **Yes**, continue to step 24.
    - If **No**, connect AC power cord. Repeat Table 511-2.

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Module LED Indications	Table 511-2 (continued) Power Supply/Controller Fault Diagnostic/Probable Cause

24. Using craft software, verify that the AC input voltage is within specification (90 - 132 for 115 VAC or 180 - 264 for 220 VAC). If within specification, the **A OK** and **B OK** radio buttons *are both **dark***.
    - If both are **dark,** the AC input voltage is within specification, the fault was not caused by the AC input. Continue to step 26.
    - If both are **clear,** the AC input voltage is either not present or not within specification, continue to step 25.
25. Check AC power supply controllers using steps 10 to 12.

Module DC converters are not within Minor Threshold Settings

Note: A minor alarm can also be caused by any of the +24, +12, or -12 VDC module DC converter outputs falling outside the *Minor Alarm threshold settings.* The module's front panel test points indicate the voltage present on the *backplane* of the shelf. The use of craft or remote network management software can be used to determine the output voltage of the module DC converters:

+24V (±10%): 21.6 to 26.4 VDC
+/-12V (±5%): 11.4 to 12.6 VDC

26. Use craft software to verify that the minor threshold settings are correct:
    - If **No**, correct settings. Repeat Table 511-2.
    - If **Yes**, continue to step 27.
27. A voltage level that causes a minor alarm does not require immediate replacement of the module. This is only a warning that one or more of the converter outputs has degraded, and that further degradation could lead to a major alarm. Replacement of the module should be taken at the earliest possible time that will not interfere with system operation.

Stop! You have completed this procedure.

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CHECK POWER SUPPLY/CONTROLLER SWITCHING (REDUNDANCY)

Summary: This procedure describes how to verify that automatic switching between primary and secondary Power Supply/Controllers installed in an HWX shelf, will occur.

Warning: *To prevent electrical shock, never work on electrical equipment in a wet location or during a lightning storm.*

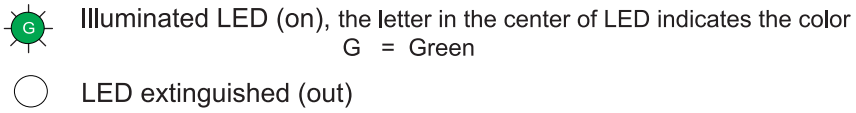
1. Obtain the following tools and equipment:
   - ESD wrist strap

Caution: *Electronic equipment can be damaged by static electrical discharge. When handling HWX-shelf units, always follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use antistatic packaging when transporting or storing units. When working on a unit, always place it on an approved, electrically grounded antistatic mat.*

2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap. Plug the ground plug into a grounded ESD jack.

3. Read the below listed note, then proceed to **Table 512, Power Supply/Controller Switching Fault Diagnostic/Probable Cause**, to verify normal switching operation between the primary and secondary Power Supply/Controller modules.

Note: Verifying normal operation and fault diagnostics portion of this procedure is set out in a sequential table format. **Module LED Indications** column can be used as a guide to fault isolation through module LED analysis. The LED indications are shown in actual module layout positions, using the following legend:



Caution: *In the following steps,* ***do not*** *use excessive force inserting or reseating modules in the equipment shelf. Although all modules can be removed or installed while the shelf is powered (hot swap) without risk of damage or system interruption, excessive insertion force (slamming the module into the shelf on insertion) may cause system interruption.*

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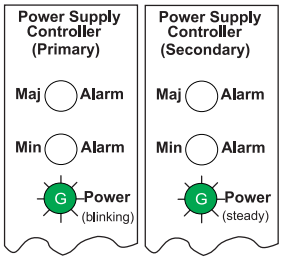
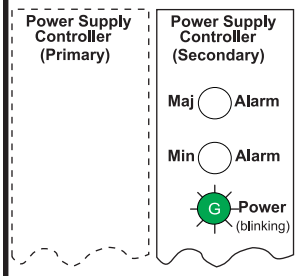
Module LED Indications — **Table 512 Power Supply/Controller Switching Fault Diagnostic/Probable Cause**

Normal Operation

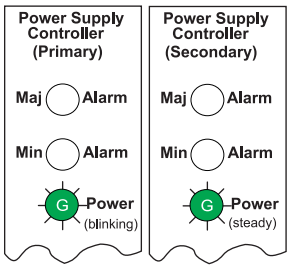


1. Check each Power Supply/Controller module installed in the HWX shelf to be sure all front panel indications are normal:
   - ***Primary*** Power Supply/Controller *green* POWER LED is blinking,
   - ***Secondary*** Power Supply/Controller *green* POWER LED is illuminated (steady), and
   - All other ALARM LEDs, on both modules, are extinguished.
2. Are all observed LED indications normal, as indicated in step 1?
   - If **Yes**, continue to step 3.
   - If **No**, return to DLP-511 to isolate and correct the abnormal Power Supply/Controller condition. Repeat Table 512.



3. Remove, or unseat, the ***primary*** Power Supply/Controller module (left slot, P1), observe that after approximately 3 seconds, the *green* POWER LED on the *secondary* Power Supply/Controller starts blinking.
   - If **Yes**, switchover to the secondary module has occurred, continue to step 4.
   - If **No**, switchover to the secondary module has not occurred, suspect faulty **secondary** Power Supply/Controller module. Remove (if an AC Power Supply/Controller module, remove power cord from the module and AC outlet) and return the faulty module to C-COR.net.

   Stop! You have completed this procedure.



4. Reinstall, or reseat, the ***primary*** Power Supply/Controller module, and observe the following:

   a. On the ***primary*** module:
   - All LEDs on the Power Supply/Controller module illuminate,
   - After approximately 3 seconds, the MIN, and MAJ ALARM LEDs extinguish, and
   - The *green* POWER LED starts blinking

   b. On the ***secondary*** module:
   - All LEDs on the Power Supply/Controller module illuminate,
   - After approximately 3 seconds, the MIN, and MAJ ALARM LEDs extinguish, and
   - the *green* POWER LED illuminates (steady).

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Table 512 (continued)

Module LED Indications	Power Supply/Controller Switching Fault Diagnostic/Probable Cause
	5. Did the above normal indications occur as indicated in step 4? • If **No**, switchover back to the primary module did not occur, suspect faulty **secondary** Power Supply/Controller module. Remove (if an AC Power Supply/Controller module, remove power cord from the module and AC outlet) and return the faulty module to C-COR.net. • If **Yes**, normal switchover back to the primary module did occur. **Stop! You have completed this procedure.**

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Page 1 of 2

INSTALLING FUNCTIONAL MODULES AND BLANK PANELS IN HWX SHELF

Summary: This procedure provides guidelines for installing functional HWX plug-in modules and blank panels in an HWX Universal Equipment Shelf.

⚠ **Warning:** *To prevent electrical shock, never install electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following tools and equipment:
   - ESD wrist strap
   - Optional HWX plug-in modules to be installed
   - Protective caps or hoods as needed to cover every fiber optic connector and bulkhead optical adapter to be dealt with at the HWX shelf location
   - HX1281BM blank panel(s) for any empty HWX shelf slots (1-8)

⚠ **Caution:** *Electronic equipment can be damaged by static electrical discharge. When handling HWX-shelf units, always follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use antistatic packaging when transporting or storing units. When working on a unit, always place it on an approved, electrically grounded antistatic mat.*

2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap. Plug the ground plug into a grounded ESD jack.

⚠ **Warning:** *Each individual plug-in module has specific* ***Danger****,* ***Warning****, and* ***Caution*** *notes associated with its installation and transmission medium. DO NOT attempt to install and/or interconnect any of the HWX plug-in modules without following its installation procedures. Appropriate installation manual part numbers are listed in the Front Matter of this manual under "Related Publications".*

⚠ **Caution:** *Do not use excessive force inserting or reseating modules in the equipment shelf. Although all modules can be removed or installed while the shelf is powered (hot swap) without risk of damage or system interruption, excessive insertion force (slamming the modules into the equipment shelf) may cause system interruption.*

⚠ **Caution:** *For EDFA Amplifiers, ensure that the Laser Keyswitch in the OFF position prior to inserting them into the shelf. Do not turn the laser "on" until a fiber optic cable has been connected to its output.*

Note: The 1550 nm Transmitter and EDFA Amplifier modules require multiple slot positions and/or have model specific shelf and Power Supply/Controller restrictions. Refer to their Instruction manuals for particulars.

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3. Install functional plug-in modules using the applicable module installation manual. Make all necessary input/output cable connections and perform initial turn-up procedure to verify normal operation. Although not required, when installing HWX plug-in modules in the shelf, it is recommended that you start at the left end of the shelf (slot 1) and proceed to the right (slot 8). Refer to Figure 513-1 for slot identifications.

4. Repeat step 3 for each functional HWX plug-in module to be installed.

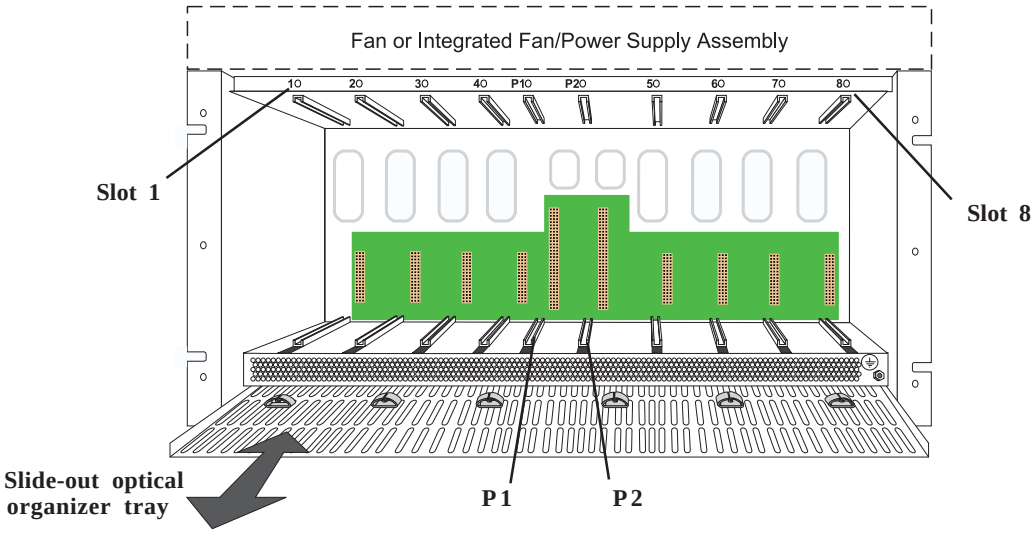

Figure 513-1. HWX Universal Equipment Shelf - Module Slot Locations

5. Cover any unused functional plug-in slots (1-8) with an HX1281BM blank panel assembly. Insert the tab at the bottom of the assembly into the slot provided for it in the floor of the shelf's module compartment. Press in the spring-loaded captive retaining screw at the top of the panel and turn it clockwise until the threads are fully engaged. Finger tighten retaining screw.

Stop! You have completed this procedure.

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APPENDIX A
POWER SUPPLY/CONTROLLER FIRMWARE FACTORY SETTINGS

Appendix A provides a list of the factory firmware settings for the HX1481PC, HX3481PC HX1AC1PC and HX1AC2PC Power Supply/Controller module parameters listed below. The factory settings can be changed by the user as required for optimum network operation.

Note: The settings listed here are current as of the date of publication of this manual. C-COR.net reserves the right to change these settings without prior notice. You may verify these settings by contacting Technical Support. For contact information, refer to *"Contacting C-COR.net Technical Support"* in the Front Matter of this manual).

1. **Battery Monitor Enabled Check Boxes**

   Enable battery: **A** (Enabled)

   Enable battery: **B** (Enabled)

2. **+24V DC Converter Voltage Alarm Threshold Settings (VDC)**

Minor		Major	
Min	**Max**	**Min**	**Max**
22.0	26.0	20.0	28.0

3. **+12V DC Converter Voltage Alarm Threshold Settings (VDC)**

Minor		Major	
Min	**Max**	**Min**	**Max**
10.5	13.5	9.5	14.5

4. **-12V DC Converter Voltage Alarm Threshold Settings (VDC)**

Minor		Major	
Min	**Max**	**Min**	**Max**
-13.5	-10.5	-14.5	-9.5

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World Headquarters
60 Decibel Road
State College, PA 16801-7580 USA
Tel: 800-233-2267, +1-814-238-2461 Fax: +1-814-238-4065
www.c-cor.net

European Office
P.O. Box 10.265
1301 AG Almere
The Netherlands
Tel: +31-36-5461111 Fax: +31-36-5364255

Canadian Office
981 Mountview Court, Oshawa,
Ontario, L1K 2M1, Canada
Tel: 905-427-0366 Fax: 905-428-0927
800-427-2559 (Toll free for Canadian call only)